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AMERICAN ANTIQUITY

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THE ARCHAIC CULTURE IN THE MIDDLE SOUTH

T. M. N. LEWIS AND MADELINE KNEBERG

ABSTRACT

Data from 22 Archaic sites in four ecologically similar regions in Kentucky, Tennessee, Alabama, and Georgia are compared to provide a synthesis of Archaic materials dating from the Anathermal to the first centuries of the Christian era in the Middle South. Stratigraphic evidence and radiocarbon dates make possible the establishment of two local sequences in western Tennessee where 15 components from ten sites can be assigned to six phases. These components are compared in terms of 83 traits through the use of the Z-coefficient described by Kroeber. Both the archaeological and the statistical analyses suggest the presence of two contemporaneous Archaic traditions in the area. The validity of this interpretation is tested by comparing the Tennessee materials with those from the Kentucky, Alabama, and Georgia regions, again with the aid of the Z-coefficient. The Archaic phases of all four regions are assigned to the two traditions: Midcontinent tradition—Eva, Three Mile, Big Sandy (Tenn.), Indian Knoll, unnamed phase which includes the Parish, Ward, and Chiggerville sites (Ky.); Eastern tradition — Stallings Island (Ga.), Lauderdale (Ala.), Kays, Weldon, Ledbetter (Tenn.). The contacts between the Archaic and Woodland traditions and the lack of contact with Early Lithic cultures are discussed.

THIS PAPER is concerned with that portion of what is often considered the Southeastern culture area which lies between 33° and 38° north latitude, a region known as the Middle South. The Southeast was at no time a single culture area any more than it was a single ecological area. It comprises the coastal plain as well as the Appalachian highland, reaching elevations of over 6000 feet above sea level in its higher part. Four divisions are represented by the 22 sites selected for this study: (1) the Kentucky region, with five sites in the valley of the Green River, and a sixth in the valley of the Tradewater River, both tributaries of the Ohio; (2) the Tennessee region, which includes ten sites along the lower portion of the Tennessee River and its affluent, the Big Sandy; (3) the Alabama region, with four sites along the middle portion of the Tennessee River; (4) the Georgia region, with two sites along the middle portion of the Savannah River.

Ecologically, these four regions are broadly similar, and probably exhibited the same degree of similarity in the past. All lie within the mid-latitude forest belt of mixed hardwoods and conifers that had the same natural resources of flora and fauna. In general, sites were located in river valleys and lowlands that were covered with hardwoods, remnants of which still persist.

The time span of the Archaic culture in this area covers more than 6000 years, beginning over 8000 years ago during the Anathermal and extending through the Altithermal and Medithermal periods into the Second Thermal Maximum of the early centuries of the Christian era. These climatic fluctuations appear to have had only minor influences upon the culture, since the animals, and presumably the plant life, were the same as those of early historic times before modern civilization modified the region.

The typical Archaic sites of this area are large shell middens, ranging in depth from a few feet to nearly 20 feet. They are invariably close to permanent streams. Less typical sites lack shell and are rarely over 3 feet deep. Some of these latter are on ridges or second bottoms. Most sites show natural stratigraphy determined by varying amounts of shell, by absence of shell, or by silt and sand alluvial deposits. All were inhabited for very long periods with little or no interruption, except in time of floods of short duration. These deep middens contain hearths, pits, burials, occasional postmolds, quantities of animal bone refuse, and artifacts, all of which accumulated slowly over some 50 centuries at the dwelling places of sedentary hunters whose culture changed but little from generation to generation.

Surveys of the Tennessee River regions have revealed numerous other Archaic sites besides those that were excavated. Although individual communities were small, a great abundance of natural resources made possible a total sedentary population of considerable size. Sites that furnished the data for this paper represent a very small sampling of human life and culture over an area of thousands of square miles. The

discussion is, therefore, bound to be an oversimplification of the history of the Archaic stage in the Middle South. However, it is an attempt to coordinate available information into a broad picture of Archaic existence in the area, to which further details may be added, or modifications made in the light of additional data.

A minimum of nine cultural phases can be distinguished in the Middle South: the Indian Knoll phase (Webb and DeJarnette 1942: 319) in the Kentucky region; the Lauderdale phase in the Alabama region; the Savannah River phase (Fairbanks 1942: 230) in the Georgia region; and the Eva, Three Mile, Kays, Weldon, Big Sandy, and Ledbetter phases in the Tennessee region. A regional sequence is available for Tennessee, but we have made no attempt to establish such sequences for the other regions. In this paper we have utilized published reports on the sites outside Tennessee. Although the sources indicate that several components may be distinguished at most of the sites, the complete data were not available for comparative studies of such components. Hence the Tennessee region will be discussed first and in more detail.

We are exceedingly grateful to H. R. Crane and James B. Griffin of the University of Michigan for four radiocarbon dates on samples from Tennessee Archaic sites. These have made possible the establishment of time horizons for the various Tennessee phases.

The Tennessee Region

Seven of the ten sites are distributed along a 60-mile stretch of the Tennessee River in Western Tennessee, between the Kentucky and Alabama borders. The other three sites are located on the Big Sandy River, the only important western tributary of the Tennessee. All sites on the Tennessee are on the west bank where some bottom lands exist, rather than the east bank which is mainly rough, poor uplands.

This region is the central part of what is called the Western Valley, a physiographic unit whose northern limit extends slightly north of the Kentucky Dam, and whose southern extent lies about 30 miles south of the Pickwick Dam. It is actually a part of the Ohio and Mississippi valley system with which it connects. Low hills on its western border form a watershed that is the source of many small rivers that drain into the Mississippi, and of many creeks and the Big Sandy River that drain northeastward into the Tennessee. Archaic settlements are located along these northeastward flowing streams, and along the nearby Tennessee River.

The following brief descriptions of the sites identify the 15 components that are used in this study (Lewis and Kneberg 1947).

Eva Site

This site is located on Cypress Creek, about 4 miles above its junction with the Tennessee River. It lies on the most elevated portion of the local bottom land, on an old natural levee formed by the Tennessee River during an aggrading phase in late glacial times. The old river bed to the east of the site is represented by Three Mile Slough. The site, apparently, was not occupied until the latter half of the Anathermal period. There were five distinct strata.

Eva I component includes Strata 4 and 5 and is represented by a shell midden deposit containing burials, fireplaces, and an abundance of artifacts. It was stratigraphically distinct, having been covered by Stratum 3, a sterile alluvium which varied from 2 to 18 inches in thickness. A sample of antler consisting of three specimens from the bottom of Stratum 4, at a depth of 6 feet below the surface was dated at 5200 B.C. ± 500 (M–357). The specimens had been chopped and cut, but were not classifiable as artifacts. The date should be interpreted as indicating a period sometime after the community had been established. The occupation on the old land surface (Stratum 5) was still earlier, but antler sufficient for dating was not available from it.

Eva II component is represented by a shell midden layer, 3 feet thick, overlying Stratum 3. It was designated Stratum 2 on the site. Burials, fireplaces, and artifacts were numerous.

Eva III component is represented by a layer of black, humic soil, 2.5 to 3 feet thick, designated Stratum 1. This layer, which contained burials, fireplaces, pits, and many artifacts, was composed mainly of occupational debris and was completely devoid of mussel shells.

Big Sandy Site

This site, located on the Big Sandy at the confluence of the West Sandy Branch lay on a low elevation of the second bottom.

Big Sandy I component, represented by a shell layer about 2 feet thick, contained burials, fireplaces, and artifacts. It was Stratum 2 on the site.

Big Sandy II component is represented by a humic layer 3 feet thick which was devoid of mussel shells. It was Stratum 1 on the site and contained burials, pits, and artifacts.

Kays Site

This is a Tennessee River site, barely evident on the surface, but having considerable depth. Three components could be distinguished.

Kays I component is from the two lowest strata, 4 and 5. Stratum 5, on the old land surface, 10 feet below the recent surface, was 2 feet thick and contained shell midden, cultural materials, fireplaces, and burials. Stratum 4 was a layer 1 to 2 feet thick consisting of alternating bands of alluvium and occupational debris. Immediately above and separating these strata from later ones,

was Stratum 3, a layer of sterile alluvium 2 feet thick. A sample of antler consisting of 14 cut fragments from Stratum 5, 8 feet below the surface, dates from 2800 B.C. ± 500 (M–108). All of the material had been worked. The date represents a late part of Stratum 5, the initial occupation on the old land surface.

Kays II component is represented by a single stratum (Stratum 2), a shellmound 3 feet high at the apex and approximately 60 feet in diameter. Fireplaces, burials, and numerous artifacts were included. A shell sample taken from the upper third of Stratum 2 yielded a radiocarbon date of 2100 B.C. ± 300 (M–109). It was originally collected as a sample for study of shell varieties. Seven cut antler fragments from Stratum 2 date from 1630 B.C. ± 300 (M–356). The mean date of these two samples is 1865 B.C. ± 300. However, we feel that the antler date is probably closer to the actual date of the upper portion of this stratum.

Kays III component was included in Stratum I and the plow zone. Stratum 1 was a combination of heavy alluvial deposit and a dark clay loam which contained considerable cultural evidence. It varied in thickness from 3 feet to a few inches above the apex of the shell heap of Component II.

Frazier Site

Located on the Big Sandy about 10 miles south of the Big Sandy site, this was an unstratified deposit 2 to 3.5 feet deep with a heavy organic content, but devoid of mussel shells. No burials, animal bone or bone artifacts were found, but postmolds were abundant.

Cherry Site

Located on a headwater branch of the Big Sandy, the deposit was 1.5 to 2 feet deep. Shell was extremely sparse, but animal bone was abundant. Burials, pits, postmolds, and many artifacts provide a relatively complete picture of a community during the late phase of the Archaic.

McDaniel Site

This site is on Lick Creek, about 4 miles above its confluence with the Tennessee. The deposit, about 2 feet thick, lacked mussel shell entirely. Postmolds, pits, burials, and artifacts represent a single component.

Thomas Site

A large, but shallow site, 1.5 to 2 feet deep, is on the Tennessee. The deposit was similar to that of the Frazier site, in that shell was absent and bone was not preserved. Acid soil conditions account for the absence of human and animal bone, since only a few badly decayed fragments were found.

Ledbetter Site

A Tennessee River site with two components, the earlier of which was too minor to handle as a separate component in this study. This early component was on the old land surface. The major occupation included two strata. Stratum 2 was about 2.5 feet thick and consisted of layers of yellow sand alternating with bands of charcoal and burned soil which indicated intermittent occupation and flood deposits. Stratum 1 was a shell midden about 2 feet thick in its deepest portion. Animal bone was abundant in Stratum 2, but comparatively rare in the shell midden deposit, indicating some difference in the economy of the people, although types of artifacts from the two strata were similar. Numerous burials in both strata showed considerable variability in burial customs.

Oak View Site

The southernmost of the group of Tennessee River Archaic sites in Tennessee. The plow zone and Stratum 1 consisted of a heavy concentration of mussel shell about 2.5 to 3 feet thick. Four lower strata represented alternating flood and thin occupation zones, about 2.5 feet thick. Pits and burials were numerous.

West Cuba Site

A Tennessee River site which consisted of two strata: Stratum 1, sandy loam grading into a thin sterile alluvium below; and Stratum 2, a layer of shell in the upper half and grading into a series of alternating alluvial and occupational deposits. The deposit, altogether, was about 4 feet thick. Although burials and artifacts were not numerous, the site is included in this paper because many of the late Archaic traits were present in the upper stratum.

These 15 components and their local sequences have furnished the data for the Tennessee regional sequence which includes the following six phases.

Eva Phase

Near the end of the Anathermal period, Archaic communities were already established in the Middle South. The ecological conditions in the river bottoms at that time were those of a typical hardwood forest. This is one of the most complex types of plant and animal communities, which makes it particularly rich in resources for food-gathering peoples. The forest fauna, as indicated by animal bones in the middens, included deer, elk, bears, rabbits, wild cats, foxes, wolves, squirrels, raccoons, opossums, beavers, otters, and wild turkeys and other large birds. The rivers and streams were rich in fish and mussels. The abundant and varied plant life that provided the basis for the complicated food chains in this type of environment was an important factor in the Archaic subsistence pattern.

The Eva community was a sedentary one, partly because of the abundance of mussels and other foods, but mainly because of a traditional culture by which it exploited all of the resources of the environment in order to maintain its pattern of life. Such communities were small and only relatively isolated, having their main outside contacts with other similar groups. Whether or not these Archaic communities were patrilocal or matrilocal joint families, or some other type of simple social group, they were probably exogamous. The two sites of this phase not only had very similar cultures,

but both revealed a parallel gradual culture change. It should be emphasized that change was gradual. The culture was highly conservative, and though changes can be demonstrated, they were practically imperceptible, except over periods involving many centuries, or some 50 to 75 generations. These small groups probably underwent almost a complete change of personnel within two generations, through births, deaths and marriage outside the group. In spite of this, factors that maintained continuity and homogeneity outweighed those leading to change. The Eva phase, represented by the two components, Eva I and Big Sandy I, began before 5000 B.C. and lasted, we believe, until about 3500 B.C., some 1500 years.

Chipped implements were the basic cutting tools. Medium to large size trianguloid blades (Fig. 2 *a*) were abundant and served as knives and choppers. Unifacial scrapers (Fig. 2 *e*), both large and small, were also characteristic, some being equipped with small spurs. Large drills of three types were used: the expanded-base (Fig. 2 *b*), stemmed (Fig. 2 *c*), and double basal-notched (Fig. 2 *c*). Among the projectile points (Fig. 1 *a-e*) the Eva basal-notched type (Fig. 1 *a*) was predominant. Side-notched points (Fig. 1 *b*) were very rare, but a straight-stemmed type (Fig. 1 *c*) was important. The only ground stone artifacts were the atlatl weights which occurred in two types, winged (Fig. 3 *a*) and cylindrical (Fig. 3 *c*). These were well made, indicating knowledge of grinding and core-drilling techniques. A few naturally shaped, flat stones were perforated for use as pendants.

Bone artifacts, which comprised a major proportion of the tools, were predominantly hide working implements (Fig. 4 *a-f*). Awls of many types, flat, perforated bodkins, and antler and bone scrapers (Fig. 5 *d*) are included in this category. Double-tapered awls (Fig. 4 *d*) may possibly have been projectile points, since antler projectile points (Fig. 4 *c*) were frequent. Bone fishhooks (Fig. 4 *h*), particularly those made from deer phalanges, were characteristic. Antler shaft wrenches (Fig. 5 *d*), handles, drifts, and flakers complete the inventory of antler tools. Bird bone beads (Fig. 5 *k*), and canines of bear (Fig. 5 *p*), bobcat, and other small mammals were used as ornaments.

Burials were predominantly fully flexed in small, circular pits, although a few were partly flexed. Dogs were buried both alone in graves, and also with humans. Red ochre occurred in some of the graves. Burial accompaniments were neither frequent nor lavish when they did occur.

Three Mile Phase

The Three Mile phase is known only from a single component — Stratum 2 on the Eva site. In the stratigraphic sequence, a sterile alluvium separated the Eva I and II components, but strong resemblances between them suggest that the Three Mile phase community was composed of descendants of the earlier Eva people. Lacking any radiocarbon sample from the component, we estimate its date at about 3500 B.C. This estimate is based upon the presence of certain types of artifacts that elsewhere are dated at about that period. It seems likely that the site was inundated by floods during some early part of the Altithermal. It was evidently abandoned for an indeterminate period and then reoccupied. In the meantime, the culture had become modified, partly by the acquisition of new traits, and partly by shifts of interest in, or emphasis upon, certain types.

Economy and burial customs were similar to those of the Eva phase, as was much of the technology. However, new types of artifacts, as well as certain new classes of artifacts, marked this epoch. (The term epoch is used here, and elsewhere in this paper, with the dictionary meaning: "An **epoch** is properly the starting point of a new period, esp. as marked by striking or remarkable changes or events; . . ." [Neilson, Knott, and Earhart 1944].) The stemmed scraper (Fig. 2 *f*) appeared, as did also an adz-like flint tool (Fig. 2 *g*). Among projectile points there was a marked shift from Eva basal-notched (Fig. 1 *a*) to Big Sandy side-notched (Fig. 1 *b*), and a large increase in the number of straight-stemmed points (Fig. 1 *c*). Three types of atlatl weights occurred: winged, prismoidal, and cylindrical (Fig. 3 *a-c*). This phase saw the introduction of the conoidal or bell-shaped pestle, and also the cylindrical form (Fig. 3 *i, j*).

The Eva type of antler atlatl hook (Fig. 5 *a*) was another new item. Made from the proximal end of the antler rather than the tine, it is a short, thick section, usually having a very small spur. Turtle shell rattles and copper beads also appeared at this time. The Three Mile phase lasted from an estimated date of about 3500 B.C. until early Medithermal times. It terminated with a climatic change which

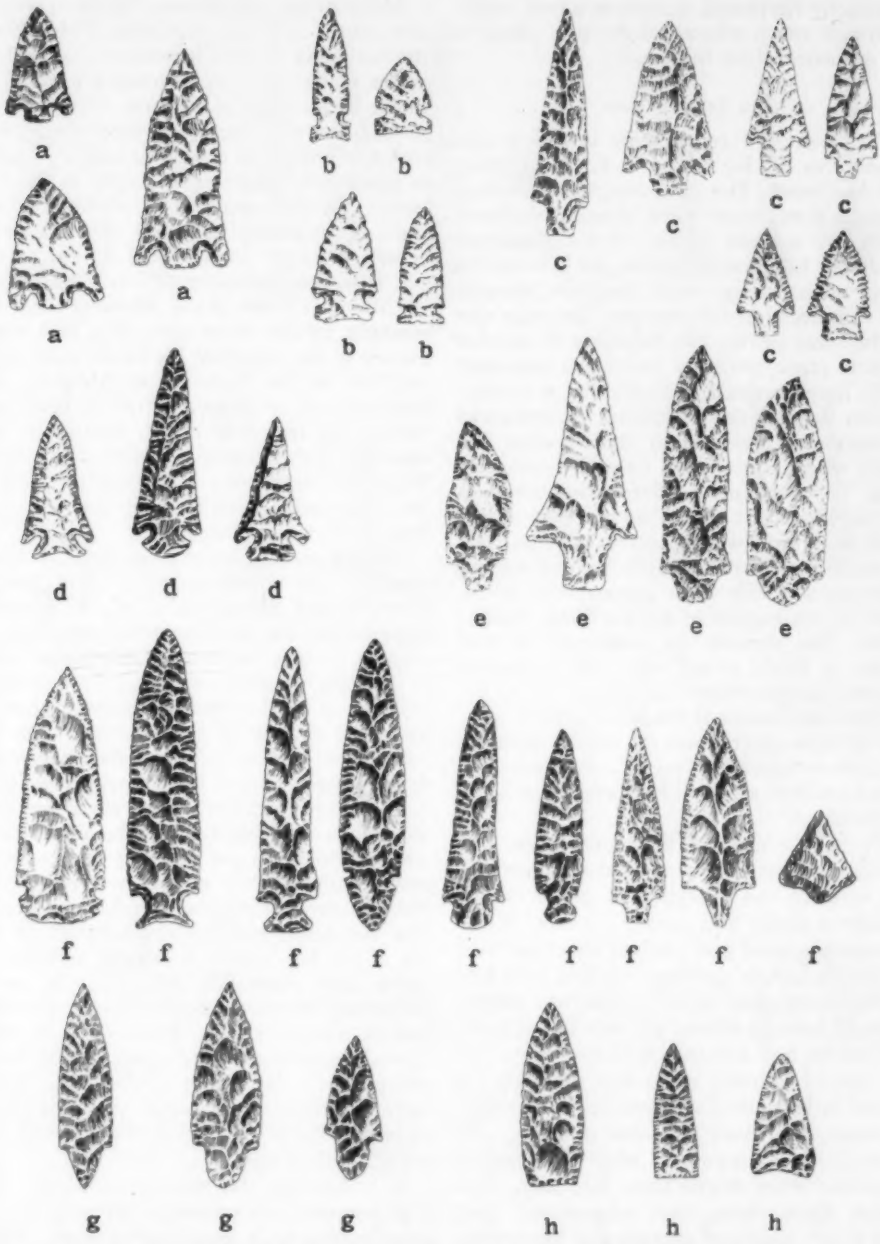

FIG. 1. Projectiles from Archaic sites in Tennessee. *a*, Eva basal-notched points; *b*, Big Sandy side-notched points; *c*, straight stemmed points; *d*, flared stemmed points; *e*, Ledbetter assymetrical stemmed points; *f*, undifferentiated stemmed points; *g*, Adena points; *h*, Frazier thinned base points.

apparently eliminated mussels as a food staple. This new epoch ushered in the next phase in the sequence — the Big Sandy.

Big Sandy Phase

Five excavated components belong to this phase: Eva III, Big Sandy II, Frazier, Cherry, and McDaniel. The most conspicuous feature of these components is the absence of mussel shells. A marked change of environmental conditions is indicated on both the Eva and Big Sandy sites. Mussel shells disappear abruptly and completely in the deposits. On other sites of the same period, but belonging to another cultural phase, extensive flooding is indicated.

We have interpreted this evidence as a rather sudden deterioration of climate, accompanied by excessive precipitation that flooded the shoals where mussels had formerly been gathered. This was quite a different situation from the periodic floods which had occurred earlier. In these latter cases, as soon as the sites were reoccupied, the mussel shells accumulated simultaneously with other occupational refuse. This did not happen in the Big Sandy components. The deposits are composed of dark brown or black, greasy soils, rich in organic content, but completely lacking in shells. Except for the absence of mussels, the basic economy of these societies was not greatly modified. Bones from species of animals represented in earlier middens are just as plentiful in middens of this phase.

We believe that the Big Sandy phase represents, in terms of time and geological periods, the onset of the Medithermal period which brought a cooler and moister climate. If the increase in annual precipitation was distributed evenly throughout the year, it would have had an important effect upon the shellfish supply. It would have broadened the beds of the rivers and creeks, and also increased their silt-carrying capacity. Deeper water plus silting of the mussel beds would have reduced the number of mussels and made them less accessible. An example of a comparable effect occurred in Tennessee when Norris Dam was built. The Clinch River, from time immemorial, had been a rich source of mussels and gastropods. The filling of the Norris reservoir caused an almost complete disappearance of most species. Only recently, after some 20 years, have they begun to increase in the headwater streams.

Medithermal conditions, which prevailed from about 1250 B.C. (Quimby 1954: 329) to the beginning of the Christian era, could have had a similar effect upon mussels in the Tennessee River. Most of the large Alabama shell-mounds reveal zones in which shells were sparse or practically absent. It was not possible to relate the Alabama stratigraphy to the Tennessee regional sequence without firsthand study of the original Alabama data. However, certain types of artifacts that appear in this period in the Tennessee sequence also appear in the upper levels of the Alabama sites. For example, tubular stone pipes (Fig. 3 *g*) which are one of the important Big Sandy traits, occur very late in the Perry site in Alabama. We have stressed the absence of mussel shells as a marker for this new epoch, because it is a consistent feature of the Big Sandy components. While its significance may only be local, it has been useful as an auxiliary means of confirming the cultural sequence.

There is no evidence that the climatic change modified the subsistence basis very greatly. Hunting and fishing provided an adequate meat supply for sedentary life, even without mussels. It may be doubted that bones found in middens would be an adequately sensitive indicator of subtle effects of climatic variations upon the ecology of river bottoms. On the other hand, it is questionable whether a minor drop in mean annual temperature and an increase in precipitation would affect the flora and fauna very markedly. The lowlands of the Middle South are generally well watered, and apparently their ecology was not greatly altered even during the Altithermal period. The Big Sandy phase is characterized by the use of pits for cooking or storage, and also by rather large postmolds, indicating the use of substantial structures. Both of these traits were lacking in earlier phases. Postmolds may reflect climatic conditions which necessitated better shelters for a large part of the year. Burial customs include an occasional extended burial, as well as the predominantly fully flexed, and minor partly flexed types.

In technology, the chipped stone adz (Fig. 2 *g*) became more common, but frequency of other cutting tools remained the same. Stemmed and side-notched scrapers (Fig. 2 *f*) outnumbered unifacial scrapers on most sites. Frequency of Eva basal-notched points declined still more, as did that of Big Sandy side-

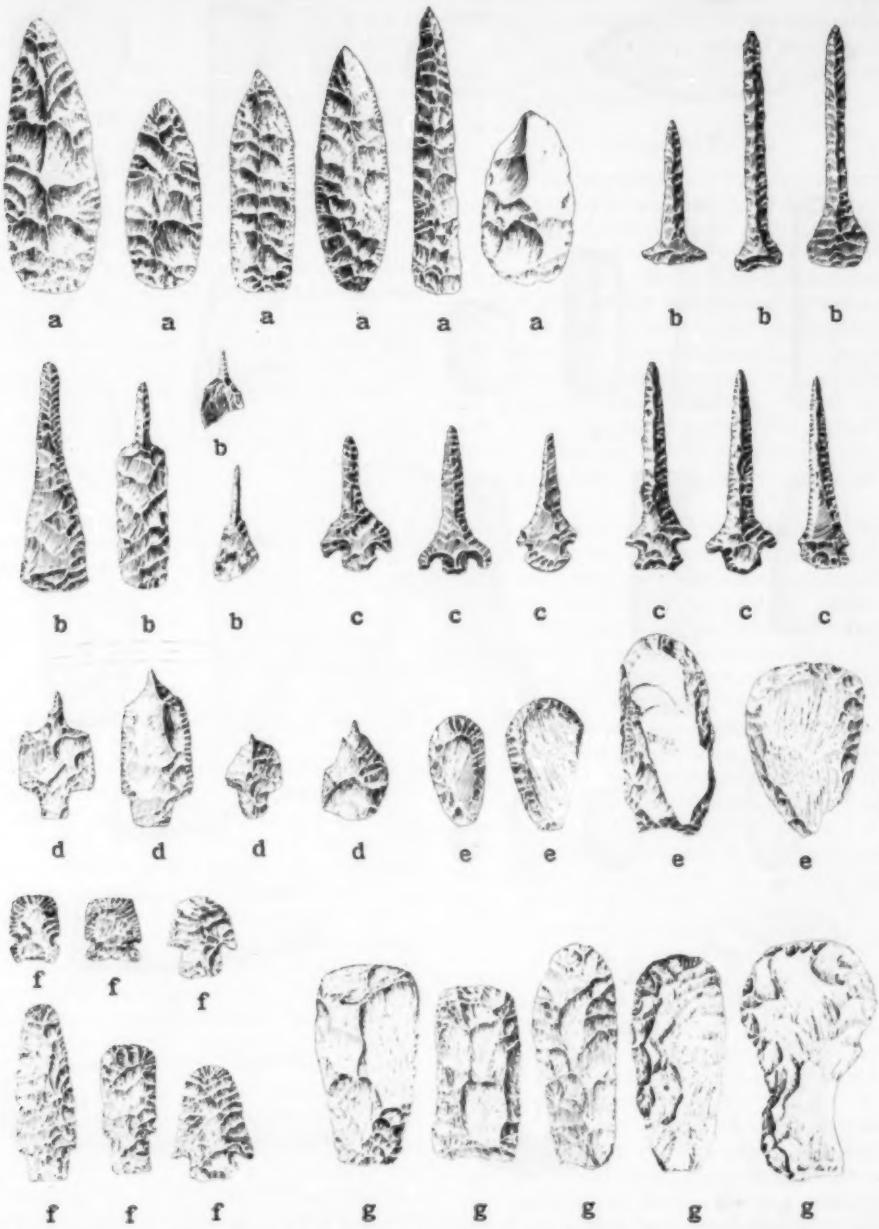

FIG. 2. Chipped implements from Archaic sites in Tennessee. *a*, medium to large blades of triangular to lanceolate form; *b*, expanded-base drills; *c*, stemmed or notched drills; *d*, gravers; *e*, uniface flake scrapers; *f*, stemmed or notched scrapers; *g*, adzes or gouges.

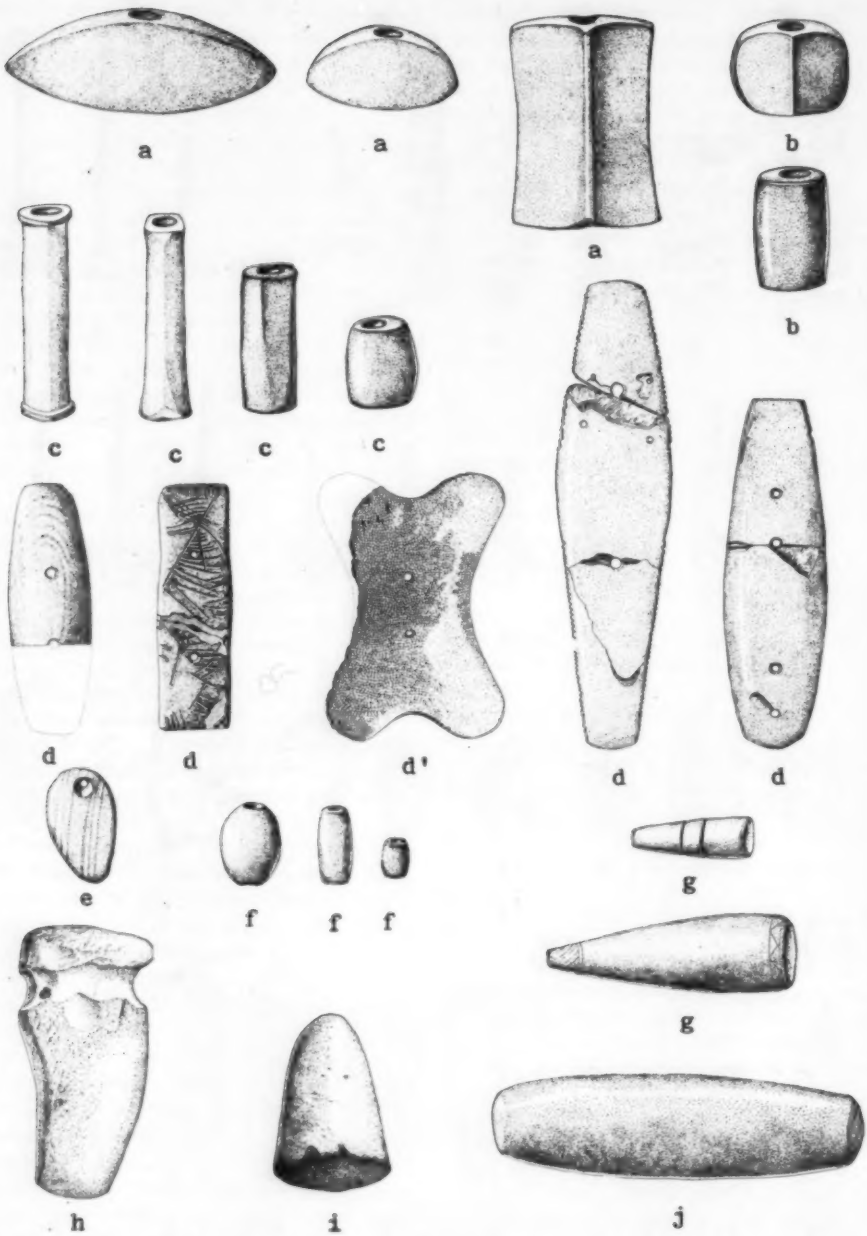

Fig. 3. Ground stone artifacts from Archaic sites in Tennessee. *a*, winged atlatl weights; *b*, prismoidal atlatl weights; *c*, cylindrical atlatl weights; *d*, oblong, or expanded center, two-hole gorgets; *d'*, reel-shaped gorget of favosites from the Weldon phase; *e*, pebble pendant; *f*, beads; *g*, tubular pipes; *h*, grooved ax; *i*, coinoidal pestle; *j*, cylindrical pestle.

notched, which was quite characteristic of the Three Mile phase. Straight-stemmed and undifferentiated stemmed points comprised nearly three-fourths of the projectile points. Three new types appeared. Manufacture of one of these, Frazier thinned base (Fig. 1 *h*; Kneberg 1956: 22), may actually have begun during the Three Mile phase, but it is mainly characteristic of the Big Sandy II component and the Frazier site. Another type is the Adena point (Fig. 1 *g*) which has a minor but significant representation in this culture. The third, and also a minor type, is the Ledbetter asymmetrical stemmed point, a large stemmed point having an asymmetrical blade and unequal shoulders (Fig. 1 *e*). Gravers, often made from broken projectile points (Fig. 2 *d*) comprise another type of artifact which appeared at this time.

Sites of this phase are the only ones that had grooved axes (Fig. 3 *h*) and celts, the latter being made of a claystone — impractical as tools but, perhaps, effective as weapons. Other ground stone objects include beads (Fig. 3 *f*), oblong and expanded center gorgets (Fig. 3 *d*), and tubular pipes (Fig. 3 *g*). Among bone artifacts were whistles or flutes (Fig. 4 *i*), cut animal jaws (Fig. 4 *l*), and perforated deer and elk astragali (Fig. 4 *m*). Marine shell artifacts include a few pendants, disc beads, one elliptical gorget, and a conch shell vessel (Fig. 5 *f-n*). One site had three occurrences of copper — two awls, and a tubular object of sheet copper.

There is some evidence to suggest that the Big Sandy phase may actually include two time horizons. The McDaniel site, in particular, had certain traits that are definitely late. This will be discussed under the Ledbetter phase. In addition to such traits as stone gorgets, Adena points, disc-shaped marine shell beads, cut animal jaws, and the use of cooking or storage pits, all of which are characteristic of Woodland cultures, a very small amount of Woodland pottery was found in components of this phase. This pottery is Baumer Fabric Marked, but it is much too scarce to represent Woodland occupations on the sites. Rather, the pottery and other occasional artifacts of Woodland types suggest contact between Woodland and Archaic peoples. During the Medithermal period, people with Woodland cultural traditions were gradually becoming established in the South. Various kinds of interaction between them and the Archaic peoples — barter, borrowing, battles, and plunder — brought about reciprocal influences upon the two cultures. Further discussion of this subject will follow the description of three other Tennessee Archaic cultures, one of which was partly coeval with the Big Sandy phase.

Kays Phase

This phase is represented by a single component on the Kays site, Kays I, which included Strata 4 and 5, and is dated 2800 B.C. ± 500 (M–108). It marks the advent of a somewhat different Archaic tradition. The climatic period was the peak of the Altithermal, yet the increased warmth apparently did not modify the environment to any great extent. However, certain features of the landscape were modified. The Tennessee River flowed at a lower level and was much reduced in size. The early Kays settlement was on an old river bank, 10 feet beneath the bank at the time of excavation in 1940.

The economy was typical Archaic, based upon hunting and the collecting of mussels and wild plant foods. In technology, certain types of artifacts were used which did not appear in the Eva sequence until the Eva II component. These were stemmed scrapers (Fig. 2 *f*), chipped adzes (Fig. 2 *g*), conoidal pestles (Fig. 3 *i*), prismoidal atlatl weights (Fig. 3 *h*), and turtle shell rattles. This suggests that the Kays and Three Mile phases were probably coeval, and that these traits may have diffused from the Kays group to the Eva group. It is of some interest that the Kays people did not bury their dogs, either in separate graves or with humans. Nevertheless, dog bones in the midden attest the presence of the domesticated dog. The antler atlatl hook of the Kays phase was the Indian Knoll type (Fig. 5 *b*). The projectile points were exclusively stemmed, the straight-stemmed point (Fig. 1 *c*) being predominant, with a type with a slightly flared stem (Fig. 1 *d*) present in small numbers. The Ledbetter asymmetrical stemmed point (Fig. 1 *e*) also occurred, but was very rare.

The population varied in certain physical traits from that of the Eva phase. The typical Kays individual was brachycranic and often orthognathous, while in the Eva phase the typical individual was dolichocranic or mesocranic, and showed some alveolar prognathism. In the Southeast, the only other brachycranic Archaic group is that of Stallings Island, although there appears to have been a tendency

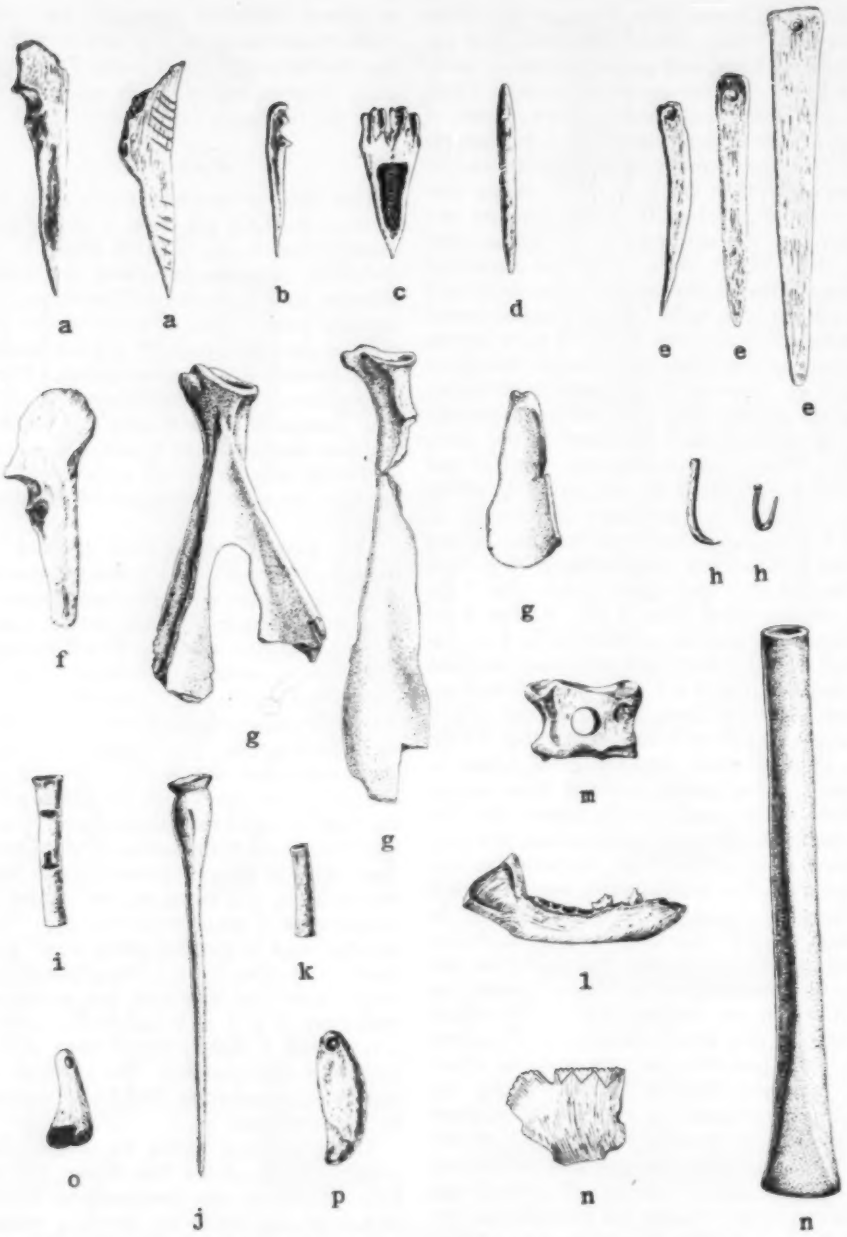

Fig. 4. Bone artifacts from Archaic sites in Tennessee. *a*, deer ulna awls; *b*, small mammal ulna awl; *c*, deer cannon bone awl; *d*, double tapered awl; *e*, perforated needles or bodkins; *f*, blunt deer ulna tools; *g*, deer scapula tools; *h*, fishhooks; *i*, whistle; *j*, pin with enlarged head; *k*, bird bone bead; *l*, cut animal jaw; *m*, perforated deer astragalus; *n*, engraved piece of human skull and tube made from human femur; *o*, pendant of turtle femur; *p*, bear canine pendant.

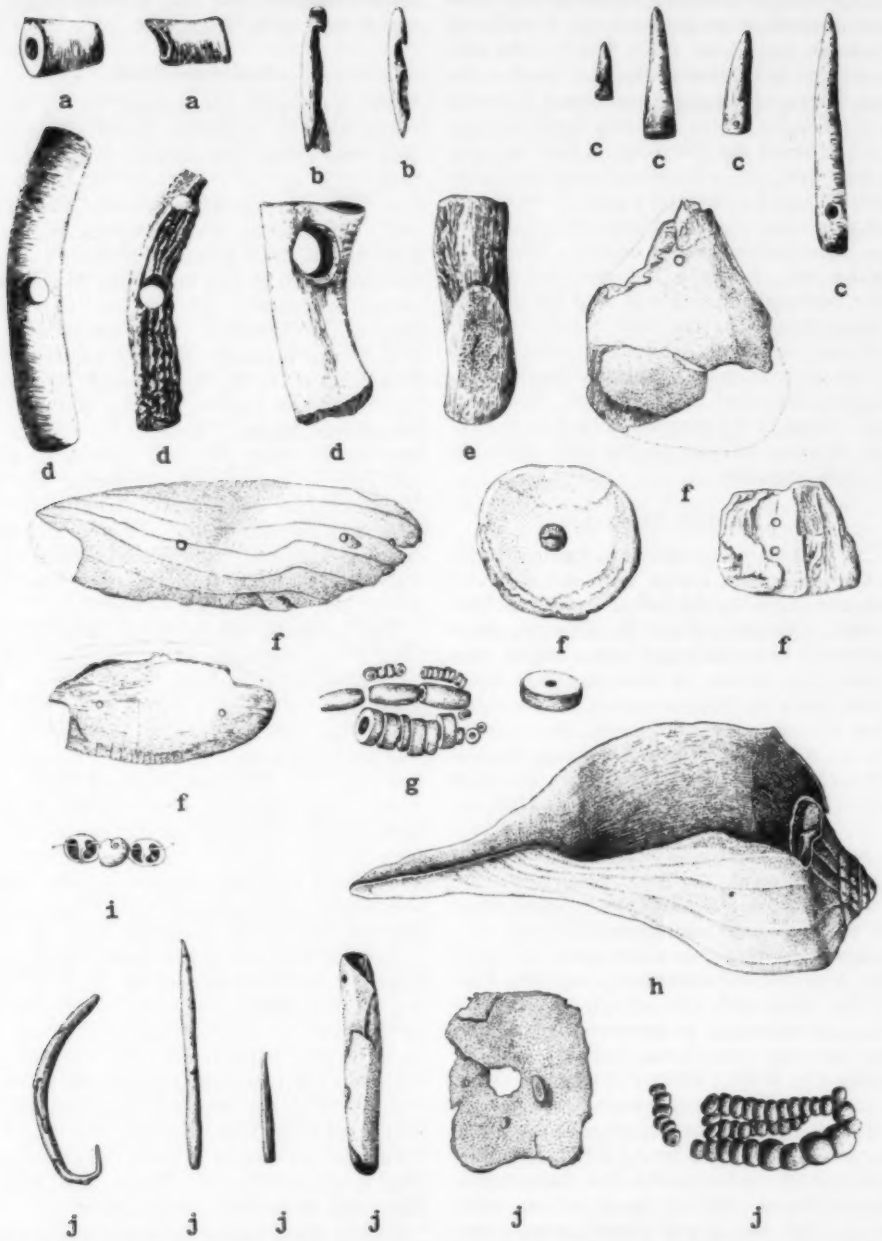

FIG. 5. Artifacts of antler, shell, and copper from Archaic sites in Tennessee. *a*, atlatl hooks, Eva type; *b*, atlatl hooks, Indian Knoll type; *c*, antler projectile points; *d*, antler shaft wrenches; *e*, antler scraper; *f*, marine shell ornaments; *g*, shell disc beads; *h*, conch shell vessel; *i*, *Anculosa* beads; *j*, copper tools and ornaments.

toward increase of head breadth in the upper series of crania from the Perry site in Alabama (Newman and Snow 1942: 406–7). As time passed, the occupation of the river bank at the Kays site was occasionally interrupted by minor floods. Finally, a very extensive flood occurred which covered the low bottom land entirely. At that time, the population moved to higher ground about a quarter of a mile to the northwest where they remained long enough to build up a considerable midden deposit. This is the Weldon site, which is not included in this paper, although the name is used for the succeeding phase. As the waters subsided, the settlement gradually shifted eastward, and midden accumulated above the adjacent sandy alluvium deposited by the flood. Finally, a shift of most of the population back to the original location ushered in the next phase in this local sequence.

Weldon Phase

The Weldon phase is not as culturally distinct as one might expect from the time difference indicated by the radiocarbon dates from its only component, Kays II. The two dates are derived from shell and antler which were in the upper portion of Stratum 2, the shell-mound above the alluvial deposit. These dates, which vary by nearly 500 years, give a mean date of 1865 B.C. ± 300, indicating an interval of about 900 years from Stratum 5 to the upper third of Stratum 2. The later date of 1630 B.C. ± 300 (M–356) may be more reliable, since it is based upon a sample of antler. This would make the interval over 1000 years long. We estimate that the Weldon phase began about 2000 B.C. and lasted until about 1200 B.C.

Among the projectile point types, the Ledbetter asymmetrical stemmed point (Fig. 1 *e*) and the type with the slightly flared stem (Fig. 1 *d*) increased in numbers. This latter type resembles the "long shallow notched" described by Webb (1950a: 306) for the Annis site in Kentucky. A single example of copper, a fishhook, appeared in this phase. Copper appeared earlier in the Three Mile phase. One other type of artifact which has some significance occurred with a burial of an adult female. This was a reel-shaped stone gorget made of favosites or honeycomb coral (Fig. 3 *d*). This type of object appears in the Baumer and Crab Orchard cultures of Illinois, as well as in the Adena culture. The presence of this artifact suggests that the Weldon phase was coeval with early Woodland.

Ledbetter Phase

Five excavated components belong to this phase: Kays III, Ledbetter, Thomas, Oak View, and West Cuba. We estimate that it persisted from 1200 B.C. to about A.D. 500. Two time horizons can be recognized in this phase which was a continuation of the same tradition as the Kays and Weldon phases. The early Ledbetter horizon, which existed during the Medithermal period, was coeval with the Big Sandy phase. Heavier precipitation, with frequent floods affected the economy of these people, just as it did that of the Big Sandy people, by restricting the mussel supply. On the Kays site the mussel-free deposit of Stratum 1 is a component that equates with this time horizon; so also is the Thomas site. On the Ledbetter and Oak View sites, the lower strata belong to this horizon, and on the West Cuba site, the upper stratum. Culturally, the two time horizons are difficult to separate, since the same basic technology was characteristic of both.

The Ledbetter asymmetrical stemmed point (Fig. 1 *e*), although not a majority type, is particularly characteristic of this phase. This point may have been a hafted knife; however, the typical Archaic trianguloid blade (Fig. 2 *a*) was just as important as in earlier periods, and was probably the main type of knife. The Adena point (Fig. 1 g), which is quite frequent, shows some differences in the two time horizons. In the Kays III component, the form has longer and narrower proportions, as regards both blade and stem; in the other components, particularly on the Ledbetter site, the form is identical with that of the classic Adena point. Copena points were present on the West Cuba and Thomas sites, eight on the former, and one on the latter. A possible Copena point was also found on the Ledbetter site. The late Ledbetter horizon is differentiated from the earlier by the presence of oblong, two-hole stone gorgets (Fig. 3 *d*), tools made from deer scapulae (Fig. 4 *g*), cut animal jaws, artifacts made of human bones (Fig. 4 *n*), and limonite blades that, in their shape and use-polish, resemble hoes.

Certain traits appear in both the Big Sandy and Ledbetter phases: Adena points (Fig. 1 g), Ledbetter asymmetrical stemmed points (Fig. 1 *e*), gravers (Fig. 2 *e*), cut animal jaws (Fig. 4 *l*), oblong or expanded center gorgets (Fig.

3 *d*), disc-shaped marine shell beads (Fig. 5 *g*), perforated deer or elk astragali (Fig. 4 *m*), limonite hoes, and elliptical marine shell gorgets (Fig. 5 *f*). The McDaniel site in particular, among components of the Big Sandy phase, shows a significant number of these traits: Ledbetter and Adena points, gravers, stone gorgets, cut animal jaws, and one limonite hoe blade. This suggests that the McDaniel site may have been a late Big Sandy component, or that its inhabitants may have had more or closer contacts with those of the Ledbetter phase.

The pottery on sites of the Ledbetter phase shows some significant variations. The Kays III component is the only one to show any Baumer Fabric Marked which is the type associated with the Big Sandy components. The other Ledbetter sites had small amounts of Long Branch Fabric Marked, another southeastern variant of the wide-spread early Woodland fabric-marked pottery. In addition to the Long Branch type, these sites also had Mulberry Creek Cord Marked and small amounts of the sand-tempered Alexander types. Only six fiber-tempered sherds were found, two in the Kays III component and four in the West Cuba site. These types are all early southeastern pottery types which could have been obtained by late Archaic peoples from neighboring Woodland peoples. The fiber-tempered pottery may have been made by Archaic people — the result of stimulus diffusion.

One of the factors which has chronological significance in the late Ledbetter horizon is the reappearance of mussels in the upper middens of the Ledbetter and Oak View sites. If the absence of mussels in the Big Sandy phase and in some of the Ledbetter components is attributable to the climatic conditions of the Medithermal, then the reappearance of mussels in the upper strata of some of the sites suggests the succeeding period. This period, which began shortly after the time of Christ, is sometimes referred to as the Second Thermal Maximum that reached two peaks at A.D. 600 and 900 (Willett 1949: 49). Its drier and warmer conditions were probably responsible for the re-establishment of mussels and their reinstatement as a food staple. In the absence of radiocarbon dates for the Ledbetter phase, the time period must remain tentative. Its earliest horizon is certainly subsequent to the Kays II date of 1630 B.C. ± 300 (M–356), and its latest horizon appears to be post-Medithermal. Just how late it persisted cannot be determined at this time.

Discussion

These brief descriptions of the six phases should make it apparent that two local sequences existed in the Tennessee region, each of which included three phases. We believe that two separate Archaic traditions are represented by the sequences, and have designated them provisionally as the Midcontinent and Eastern traditions. Our reconstruction of their position in time and relationships with other centers appears in Figure 7. Long-continued association of peoples of the two traditions in the same region resulted in gradual obliteration of distinctions in culture, and in development of a single, more uniform area tradition. Interaction between Archaic and Woodland peoples was also an important factor in furnishing certain common traits. Thus, it was actually the coalescence of three traditions that produced the late Archaic culture.

As was pointed out by Phillips and Willey (1953: 630) it is difficult to define any taxonomic unit higher than the phase by a trait list that specifies its formal content. This is the problem that arises in defining a tradition which, while not a taxonomic unit, shares some of the characteristics of such units. As an historical integrative device, its implications are basically genetic, as Rouse (1955: 718–9) has emphasized. In the taxonomy of biological species, the higher taxonomic units are defined by more and more generalized traits. So in archaeology, any device that integrates phases into larger groupings operates mainly by employing generalized traits. If a tradition is "a major large-scale space-time-cultural continuity" (Phillips and Willey 1953: 628) it involves the persistence of a group of conventions within whose limits cultural change takes place. But to define such conventions in terms of specific traits is difficult. The recognition of a tradition is inevitably a subjective evaluation of many diverse factors such as the meaning of the stratigraphy found on sites, the significance of certain traits, the relationships of types in artifact type sequences, the differential frequencies of types, and some intangibles, perhaps.

Statistical methods that deal with presences and absences of traits are crude enough devices when trait lists of components are compared, yet the results of such statistical analysis may

serve as convenient means of presenting data objectively. However, as research tools for establishing phases, the quantitative methods are merely one kind of operation that an archaeologist performs in interpreting his data. A phase is a mental construct that the archaeologist believes is an approximation of the facts. If statistical methods confirm the results of the other operations that he has used in arriving at the mental construct, they are accepted. But if they contradict the results of the other operations, the construct is not thereby rejected. Ordinary quantitative methods are not satisfactory in comparing sites with unequal quantities of data. As for example, in comparing the Frazier and Cherry sites, most of their nonperishable traits were shared, but at the Frazier site no perishable materials were preserved. Thus, there are only 24 identifiable traits from the Frazier site while there are 60 from the Cherry site. Any results obtained from comparisons where such unequal quantities of traits are used may be misleading, and common sense evaluations are more dependable. Moreover, misleading results also will be obtained in comparisons of sites where both have small numbers of traits.

Although we recognize these limitations and qualifications, we have subjected our data to a rather simple but useful statistical analysis, the Z-coefficient described by Kroeber (1940: 29–44), in order to objectify our original subjective grouping of components into phases. The method employs four-cell values: *a*, traits present in both units compared; *b*, present in one, and absent in the other; *c*, the reverse of *b*; and *d*, absent in both. For a discussion of the method, its theoretical implications, and limitations, the reader is referred to the original Kroeber article.

Table 1 shows the distribution of the 83 traits used in the study. Table 2 shows the Z-coefficients derived from the formula $\frac{(a+d)-(b+c)}{N}$, N being the 83 traits. This list of traits includes only those which occur in two or more components. Since most of the traits occur in a third or more of the components, we believe that they provide an adequate basis for determining the degree of resemblance between any two components. Five universal positive traits have been included because they do indicate the basic similarities of all of the Archaic units. Elimination of these would not have affected the coefficient relationships as a whole. Useful as it is, this statistical device does not produce satisfactory results where phase trait lists are compared with each other, for the coefficients do not reflect the underlying conventions which link the phases into traditions.

Figure 6 demonstrates the method by which the Midcontinent tradition was in part inferred from the statistical data on the interlocking stratigraphic sequence of the Eva and Big Sandy sites. The arrows which indicate the comparisons and their Z-coefficient values are based upon detailed studies of all the data from these sites. Each one shows a definite continuity from early to late components. The intersite component comparisons show certain high Z-coefficient values, particularly between Eva I and Big Sandy I, and between Eva III and Big Sandy II. Taking all of the factors into consideration, we feel justified in stating that the Eva, Three Mile, and Big Sandy phases constitute a cultural tradition that lasted nearly 5000 years.

It is an obvious impossibility to list the trait content of such traditions, particularly when they gradually merge with another tradition. The two conventions which identify the Midcontinent tradition, especially in early phases, are the attitude toward dogs and the emphasis upon notching in projectile points. The careful burial of dogs, either alone or with humans, reflects the attitude of the Midcontinent people toward their dogs. This was not shared by the people of the Eastern tradition until a very late period. Notching of projectile points is a trait that is almost entirely absent in the Eastern tradition. Were these traits the sole basis for asserting that there were two traditions, the

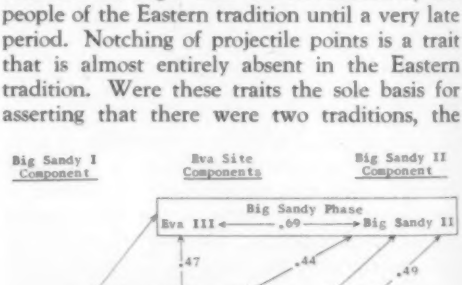

Fig. 6. Diagram illustrating the use of the Z-coefficient values between the components of the Eva, Three Mile, and Big Sandy phases to demonstrate the Midcontinent tradition.

interpretation would have much less validity. We believe that the archaeological data as a whole corroborate the hypothesis that the region was occupied by peoples of two different traditions.

A brief reconstruction of the history of the Archaic stage of culture in the Tennessee region can be suggested. Sometime before 5000 B.C. people coming from a northwesterly direction and having a culture pattern of the Midcontinent tradition arrived in the region. Later on, perhaps 1000 years later, new groups with a somewhat different tradition entered the region, possibly from a southeasterly direction. No conflict between the two groups is indicated, and they mutually influenced each other as time went on without losing their identity. By the Medithermal period, the advent of peoples of the Woodland tradition added a third element to the developing culture of the area. The validity of this interpretation depends upon whether or not the archaeology of surrounding regions can be fitted into it. We shall consider the Kentucky, Alabama, and Georgia data in the following section of this paper.

THE KENTUCKY REGION

Five of the six Kentucky sites are in the Green River valley, and the sixth, in the valley of the Tradewater River, flowing roughly parallel to the Green, and, like it, emptying into the Ohio.

READ SITE

This is a shell midden on a bluff, 70 to 80 feet above the Green River (Webb 1950b). The average depth, about 45 inches, indicates habitation over a considerable time.

INDIAN KNOLL

This large shell midden is located on bottom land about 700 feet from the Green River (Webb 1945). The midden, which varied from 5 to 8 feet in depth, lacked natural stratigraphy and appeared to have accumulated through many centuries of uninterrupted occupation. Radiocarbon shows a maximum date of 3352 B.C. ± 300 (C–254) and a minimum date of 2013 B.C. ± 350 (C–741).

ANNIS SITE

This shell midden on bottom land of the Green River valley has a maximum depth of about 7.5 feet, but lacks stratification (Webb 1950a). The maximum age indicated by the radiocarbon sample from the 6.5-foot level is 2950 B.C. ± 250 (C–251).

CHIGGERVILLE SITE

This site is a shell midden on bottom land of the Green River valley near a large shoal (Webb and Haag 1939). The site is an extensive one and was apparently inhabited for a long period, although no radiocarbon dates are available to confirm this assumption.

WARD SITE

In contrast to the other typical shellmound sites of the Green River valley, this site had little shell (Webb and Haag 1940). It lies on a ridge above Cypress Creek, an affluent of the Green River.

PARRISH SITE

This site lies on a ridge above Weirs Creek which drains into Clear Creek, an affluent of the Tradewater River (Webb 1951). Shell was absent from the deposit which apparently was about 3 feet in depth.

The trait content of these sites is shown in Table 1, and the Z-coefficients derived from site comparisons appear in Table 2. Lacking any firsthand acquaintance with the Kentucky data, we have been obliged to rely upon statistical analysis for interpreting the relationships of these sites. On that basis, the sites fall into two groups which probably should be considered as two separate phases. However, we have included them in a single one, the Indian Knoll phase, and will indicate what might comprise a second phase that we hesitate to designate by a specific name.

In the first group the Read and Annis sites show a very high Z-coefficient (.73), and Read also shows a high Z-coefficient (.66) with Indian Knoll, although the Indian Knoll–Annis coefficient of .49 is relatively low. These three sites form a group to which Chiggerville might also be assigned on the basis of a coefficient of .57 with Indian Knoll. However, Chiggerville has its highest coefficient (.71) with the Ward site. The latter shows low coefficients with Read, Annis, and Indian Knoll. This suggests that Chiggerville had two components, one of which should be assigned to the first group, or Indian Knoll phase proper, and the other to another phase which includes the Ward site.

The second group would also include the Parrish site with a coefficient of .52 with Ward. Parrish is the most divergent of the Kentucky sites; in fact, its highest coefficient (.54) is with the McDaniel site of the Big Sandy phase in Tennessee. Furthermore, the Z-values of the Parrish site with other Big Sandy components are higher than with any of the Kentucky sites, except Ward. We interpret these results as indicating that the Parrish site was coeval with the Big Sandy phase. If true, the Ward site should belong to the same time horizon. Both of these sites, like the Big Sandy site, showed a deficiency of mussels, which suggests that they also were inhabited during the Medithermal period.

TABLE 1. DISTRIBUTION OF TRAITS IN COMPONENTS.

TRAITS	Trait number	Figure number	Eva I	Big Sandy I	Eva II	Eva III	Big Sandy II	Frazier	Cherry	McDaniel	Kays I	Kays II	Kays III	Thomas	Ledbetter	Oak View	West Cubs	Read	Indian Knoll	Annis	Chiggerville	Ward	Parrish	Malberry Creek	Perry	Bluff Creek	Long Branch	Stallings Island	Lake Spring
Community plan																													
Shell mound refuse heap	1		X	X	X						X	X			X	X	X	X	X	X	X			X	X	X	X	X	X
Fireplaces in shell midden	2		X	X	X						X	X			X	X	X	X	X	X	X			X	X	X	X	X	X
Postmold evidence of shelters	3							X	X	X													X	X	X	X	X		
Pits for cooking and/or storage	4					X	X	X	X	X				X		X		X		X	X	X	X		X	X		X	X
Burial concentrations	5		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Subsistence pattern																													
Sedentary food gathering economy	6		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hunting of large and small game	7		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Collecting mussels for food	8		X	X	X						X	X			X	X	X	X	X	X	X	X		X	X	X	X	X	X
Fishing	9		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X
Burials customs																													
Burials in shell midden	10		X	X	X						X	X			X	X	X	X	X	X	X			X	X	X	X	X	
Circular burial pits	11		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Burial accompaniments	12		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fully flexed position predominant	13		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Partly flexed position minor	14			X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Extended position rare	15					X	X		X									X		X	X	X	X			X	X		
Seated position rare	16				X										X									X	X	X	X		
Burial of partly cremated remains rare	17														X	X								X	X	X	X		
Dogs buried with humans	18		X		X	X			X	X						X			X	X	X	X		X	X	X	X		
Dogs buried alone in graves	19		X	X	X	X	X		X	X			X		X	X		X	X	X		X		X	X	X	X		
Artifacts																													
Chipped stone																													
Eva basal notched points	20	17a	X	X	X	X	X	X	X	X																			
Big Sandy side notched points	21	17b	X	X	X	X	X	X	X	X								X	X	X	X	X	X						
Straight stemmed points	22	17c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Flared stemmed points	23	17d	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
Ledbetter stemmed points	24	17e							X	X	X	X	X	X	X	X	X							X	X	X		X	X
Undifferentiated stemmed points	25	17f	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Adena points	26	17g						X	X	X			X	X	X	X	X			X			X						
Frazier thinned base points	27	17h					X	X	X	X									X										
Medium to large triangular or lanceolate blades	28	18a	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Expanded base drills	29	18b	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stemmed or notched drills	30	18c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gravers	31	18d				X	X	X	X	X				X	X	X			X	X			X						X
Uniface flake scrapers	32	18e	X	X	X	X	X	X	X	X	X	X		X	X			X	X	X	X	X	X						
Stemmed or notched scrapers	33	18f			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X	
Adzes or gouges	34	18g			X	X	X	X	X	X	X	X	X	X		X	X		X				X						

Ground stone																													
Winged atlatl weights	35	19a	X	X	X	X	X		X		X	X					X	X	X	X	X	X				X	X	X	
Prismoidal atlatl weights	36	19b			X		X		X	X	X		X				X	X	X	X	X	X		X		X	X	X	
Cylindrical atlatl weights	37	19c		X	X	X	X	X	X																				
Oblong or expanded center 2-hole gorgets	38	19d				X				X					X	X	X						X	X	X	X	X		
Pendants	39	19e	X	X													X	X							X	X			
Beads	40	19f						X	X			X	X	X			X	X	X	X				X	X	X				
Tubular pipes	41	19g				X	X		X										X					X						
Grooved axes	42	19h							X	X							X	X	X	X	X	X	X	X	X	X	X		
Conoidal and bell-shaped pestles	43	19i			X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	X	X	X	X			
Cylindrical pestles	44	19j			X		X		X								X	X	X	X									
Mortars	45		X		X												X	X		X	X	X	X	X	X	X	X	X	
Nutstones	46		X		X			X									X	X	X	X	X	X	X	X	X	X			
Pitted hammerstones	47		X	X	X	X	X	X	X					X	X	X		X	X		X	X					X		
Red ocher	48		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X						
Bone, antler, and teeth																													
Splinter awls numerous	49		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Deer ulna awls	50	20a	X	X					X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Small mammal ulna awls	51	20b	X		X						X							X	X	X	X								
Deer cannon bone awls	52	20c	X	X	X		X		X		X				X	X	X	X	X	X	X	X	X	X			X	X	X
Turkey tibiotarsus awls	53		X	X	X		X		X		X	X			X	X	X	X	X		X	X		X	X	X			
Double-tapered awls (projectile points ?)	54	20d	X		X										X		X	X	X	X				X	X	X	X		
Needles or bodkins (perforated)	55	20e	X		X	X	X		X		X						X	X	X	X	X							X	
Raccoon baculum bodkins	56															X		X	X										X
Blunt deer ulna tools	57	20f	X	X	X	X	X		X		X	X			X		X	X			X		X					X	X
Deer scapula tools	58	20g													X	X		X		X									
Fishhooks	59	20h	X	X	X	X					X	X			X	X	X	X	X	X				X	X	X	X	X	X	X
Whistles or flutes	60	20i							X			X				X		X	X										
Pins with enlarged heads	61	20j													X			X	X								X	X	
Bird bone beads	62	20k	X	X	X		X		X	X					X	X		X	X										
Cut animal jaws	63	20l								X					X	X		X										X	
Perforated deer or elk astragali	64	20m							X							X	X	X	X										
Human bone artifacts	65	20n													X	X		X	X					X		X	X		
Pendants of turtle femur	66	20o													X		X										X		
Turtle shell rattles	67				X	X					X							X	X	X									
Bear canine tooth pendants	68	20p	X		X						X								X		X								
Bobcat or small mammal canine tooth pendants	69		X	X					X		X					X		X		X			X						
Beaver incisor tools	70		X		X	X			X		X					X		X	X										
Antler atlatl hooks, Eva type	71	21a			X	X			X															X			X		
Antler atlatl hooks, Indian Knoll type	72	21b									X						X	X	X	X	X			X		X	X	X	
Antler projectile points	73	21c	X	X	X	X	X		X		X		X		X		X	X	X	X	X			X	X	X	X	X	X
Antler shaft wrenches	74	21d	X	X	X	X	X		X									X						X	X	X	X		
Antler scrapers	75	21e	X	X	X	X	X		X	X	X		X		X	X	X	X		X			X					X	
Antler handles	76		X	X	X						X							X	X									X	
Antler drifts	77		X						X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Antler flakers	78		X	X	X	X	X		X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shell																													
Marine shell ornaments	79	21f							X						X			X	X	X	X	X					X		
Disc beads	80	21g							X						X			X	X	X	X	X		X	X	X	X		
Vessels of marine shell	81	21h							X											X									
Anculosa beads	82	21i					X		X		X				X	X	X		X		X	X		X	X	X			
Copper tools and/or ornaments	83	21j			X				X			X		X	X	X			X				X						
Total traits			47	40	54	42	43	24	60	40	44	33	25	20	51	50	36	63	63	64	49	43	39	44	43	46	47	40	28

When these Kentucky sites are compared with the Tennessee components they generally show higher coefficients with those that we consider to belong in the phases of the Midcontinent tradition. Read, with a coefficient of .42 with Eva I, shows its closest outside relationship with the Eva phase. Indian Knoll shows its highest outside coefficient (.49) with the Eva II component of the Three Mile phase. Annis, on the other hand, does not show any significantly high coefficient with any of the Tennessee components. Chiggerville shows several relatively high coefficients: .42 with Eva I, .49 with Kays I, .44 with Mulberry Creek and Bluff Creek sites in Alabama, and with Stallings Island in Georgia. This tends to confirm our impression of two components on the Chiggerville site. Ward shows its highest outside coefficient (.49) with Stallings Island, although it also shows coefficients of .44 with Mulberry Creek and Bluff Creek. Furthermore, it has a coefficient of .42 with the Big Sandy II component, which has some significance in view of the relationship of the Parrish site to the Big Sandy phase. Parrish, as has been mentioned, shows its highest coefficient with the McDaniel site, and relatively high coefficients with the other Big Sandy components. However, it also shows a relatively high coefficient (.47) with the Kays III component.

In summary the group comprising Read, Annis, Indian Knoll, and the early Chiggerville component was probably coeval with the Eva and Three Mile phases and is representative of the Midcontinent tradition. The late Chiggerville component apparently was coeval with the Kays phase and may reflect contact with people of the Eastern tradition. The Ward and Parrish sites were probably coeval with the Big Sandy phase, although the Ward site may have been occupied earlier, during the Altithermal. These latter sites, like those of the Big Sandy and Ledbetter phases, are representative of the late Archaic culture (Fig. 7).

The Alabama Region

The four sites in the northern Alabama region were located along a 20-mile stretch of the Tennessee River (Webb and DeJarnette 1942).

Mulberry Creek Site (Ct°27)

This is a deep shell deposit, averaging about 17 feet in depth. Several strata exist, the upper half generally showing sparse shell, the lower half showing alternating layers of dense shell and alluvial deposits. Since it has not been possible to differentiate stratigraphic components, the site has been treated as a single component.

Perry Site (Lu°25)

This large shellmound is on the upper end of a large island. It has a 7.5-foot thick deposit that varies from dense shell layers to clay and humus, the upper portion generally showing less shell than the lower. The only radiocarbon date available from the Alabama sites is from the 3.5-(C–756) to 4.0-(C–755) foot level of this site. These samples, which were mixed about equally to provide sufficient carbon for measurement, yield a date of 2814 B.C. ± 250 and represent a period when about half of the deposit had accumulated. The original occupation must have begun many centuries earlier, and the site was probably inhabited up to and into the Medithermal period.

Bluff Creek Site (Lu°59)

A bottom land shellmound composed of a number of strata making a total depth of 17 feet. Flooding of the site took place several times as indicated by silt strata. Dense shell layers occurred throughout, almost up to the surface. In this characteristic the site differed from the Mulberry Creek and Perry sites.

Long Branch Site (Lu°67)

The shellmound that forms this site was approximately 11 feet deep, and showed several strata. Mussel shells were abundant, and no climatic variation is indicated by difference in the content of the strata.

Webb and DeJarnette (1942: 314) designated the Alabama Archaic sites as the Lauderdale focus. We have employed the term Lauderdale phase in this paper. Considering the length of occupation that is indicated by the depth of the sites, a single phase is an oversimplification of the Alabama Archaic. However, we do not feel justified on the basis of this study to suggest how another phase might be defined. The intersite coefficients are very high although the Long Branch site shows relatively lower coefficients with the Mulberry Creek and Perry sites. None of the Alabama sites shows high coefficients with components outside the region, the highest being with the Chiggerville and Ward sites in Kentucky, with the Ledbetter and West Cuba sites in Tennessee, and with Stallings Island in Georgia.

We believe that more significant relationships might be discovered if the Alabama sites could be divided into components, which undoubtedly exist. Nevertheless, we consider that the Lauderdale phase belongs to the Eastern tradition, rather than to the Midcontinent. We would suggest that the Alabama shellmound Archaic occupation began prior to 3500 B.C. and persisted about to the beginning of the Christian era. Evidence from an earlier Ar-

TABLE 2. Z-COEFFICIENT VALUES.

	Eva I	Big Sandy I	Eva II	Eva III	Big Sandy II	Frazier	Cherry	McDaniel	Kays I	Kays II	Kays III	Thomas	Ledbetter	Oak View	West Cuba	Read	Indian Knoll	Annis	Chiggerville	Ward	Parrish	Mulberry Cr.	Perry	Bluff Cr.	Long Branch	Stallings Is.	Lake Spring
Eva I		.73	.64	.30	.28	-.04	.28	.16	.44	.23	.18	-.13	.23	.19	.30	.42	.42	.20	.42	.37	.06	.04	.06	-.01	-.04	.35	.37
Big Sandy I	.73		.52	.42	.49	.13	.30	.23	.47	.40	.40	.04	.35	.28	.42	.30	.20	.13	.30	.35	.30	.32	.20	.23	.20	.42	.37
Eva II	.64	.52		.47	.44	-.01	.23	.13	.47	.37	.11	-.06	.20	.16	.18	.35	.49	.24	.40	.25	.20	.28	.16	.08	.16	.23	.08
Eva III	.30	.42	.47		.69	.44	.42	.42	.28	.20	.40	.23	.06	.18	.18	.06	.06	.13	.20	.35	.40	.08	.11	.04	.06	.23	.18
Big Sandy II	.28	.49	.44	.69		.35	.54	.44	.32	.18	.32	.25	.18	.16	.20	.13	.18	.11	.30	.42	.47	.06	.08	-.03	-.06	.20	.20
Frazier	-.04	.13	-.01	.44	.35		.08	.42	-.11	.30	.44	.71	-.13	-.01	.13	-.16	-.18	-.25	-.06	.06	.44	-.06	-.04	-.11	-.18	-.06	.18
Cherry	.28	.30	.23	.42	.54	.08		.42	.13	.11	.11	.04	.11	.23	.08	.16	.25	.32	.25	.35	.40	.04	.06	-.01	-.13	-.01	-.06
McDaniel	.16	.23	.13	.42	.44	.42	.42		.28	.35	.54	.37	.28	.42	.37	.01	.06	.06	.16	.30	.54	.13	.20	.13	.06	.28	.28
Kays I	.44	.47	.47	.28	.32	-.11	.13	.28		.59	.40	.16	.35	.37	.37	.40	.40	.23	.49	.41	.30	.32	.25	.23	.16	.52	.40
Kays II	.23	.40	.37	.20	.18	.30	.11	.35	.59		.52	.49	.32	.40	.54	.16	.23	.06	.37	.37	.42	.30	.37	.20	.28	.40	.35
Kays III	.18	.40	.11	.40	.32	.44	.11	.54	.40	.52		.54	.40	.30	.52	-.06	-.06	-.04	.16	.28	.47	.25	.28	.20	.13	.35	.44
Thomas	-.13	.04	-.06	.23	.25	.71	.04	.37	.16	.49	.54		.06	.13	.23	-.23	-.18	-.23	.06	.11	.44	-.01	.06	-.06	-.13	.13	.32
Ledbetter	.23	.35	.20	.06	.18	-.13	.11	.28	.35	.32	.40	.06		.49	.54	.28	.23	.20	.23	.23	.18	.40	.32	.30	.32	.40	.23
Oak View	.19	.28	.16	.18	.16	-.01	.23	.42	.37	.40	.30	.13	.49		.32	.25	.20	.28	.16	.16	.25	.32	.25	.28	.06	.28	.28
West Cuba	.30	.42	.18	.18	.20	.13	.08	.37	.57	.54	.52	.23	.54	.32		.06	.06	.04	.30	.25	.30	.42	.40	.37	.20	.47	.47
Read	.42	.30	.35	.06	.13	-.16	.16	.01	.40	.16	-.06	-.23	.28	.25	.06		.66	.73	.51	.42	.23	.16	.08	.20	.23	.35	.06
Indian Knoll	.42	.20	.49	.06	.18	-.18	.25	.06	.40	.23	-.06	-.18	.23	.20	.06	.66		.49	.57	.38	.10	.25	.13	.20	.28	.20	.06
Annis	.20	.13	.24	.13	.11	-.25	.32	.13	.23	.06	-.04	-.25	.20	.28	.04	.73	.49		.40	.30	.10	.08	.11	.13	.11	.18	.08
Chiggerville	.42	.30	.40	.20	.32	-.06	.25	.16	.49	.37	.16	.06	.23	.16	.30	.51	.57	.40		.71	.37	.44	.42	.44	.32	.44	.35
Ward	.37	.35	.25	.35	.42	.06	.35	.30	.41	.37	.28	.11	.23	.16	.25	.42	.38	.30	.71		.52	.44	.42	.44	.37	.49	.40
Parrish	.06	.30	.20	.40	.47	.44	.40	.54	.30	.42	.47	.44	.18	.25	.30	.23	.10	.10	.37	.52		.16	.13	.11	.11	.30	.35
Mulberry Creek	.04	.32	.28	.08	.06	-.06	.04	.13	.32	.30	.25	-.01	.40	.32	.42	.16	.25	.08	.44	.44	.16		.73	.80	.69	.37	.35
Perry	.06	.20	.16	.11	.08	-.04	.06	.20	.25	.37	.28	.06	.32	.25	.40	.08	.13	.11	.42	.42	.13	.73		.83	.66	.40	.35
Bluff Creek	-.01	.23	.08	.04	-.03	.11	-.11	.13	.23	.20	.20	-.06	.30	.28	.37	.20	.20	.13	.44	.44	.11	.80	.83		.78	.37	.37
Long Branch	-.04	.20	.16	.06	-.06	-.18	-.13	.06	.16	.28	.13	-.03	.32	.06	.20	.23	.28	.11	.32	.37	.11	.69	.66	.78		.40	.25
Stallings Island	.35	.42	.23	.23	.20	-.06	-.01	.28	.52	.40	.35	.13	.40	.28	.47	.35	.20	.18	.44	.49	.30	.37	.40	.37	.40		.63
Lake Spring	.37	.37	.08	.18	.20	.18	-.06	.28	.40	.35	.44	.32	.23	.28	.47	.06	.06	.08	.35	.40	.35	.35	.35	.37	.25	.63	

chaic phase in Alabama at Russell Cave (Miller 1958) will certainly modify this interpretation, but since no detailed report is available at present the interrelationships cannot be determined.

The Georgia Region

The two sites of Stallings Island and Lake Spring are the main components of the Savannah River phase, although at least ten other Archaic sites have been noted in the same region.

Stallings Island Site

The shellmound, which averaged between 3 and 4 feet in depth, is situated on an elevated clay erosional remnant on an island in the Savannah River (Claflin 1931). It varied from many of the southeastern shellmounds in having a lesser depth, but even this amount of accumulation may represent a long period. A second non-Archaic component was present.

Lake Spring Site

A shell midden located some miles upstream from Stallings Island (Miller 1949). The greatest depth of the deposit was 5 feet, the upper portion of which appears to represent a second non-Archaic component.

The Archaic components of these two sites were quite similar, showing a relatively high Z-coefficient (.63). Due to limited excavations on the Lake Spring site, there were only 28 traits that could be used in this study; the Stallings Island site furnished 40. A truer evaluation can be obtained from comparisons using the Stallings Island data.

Outside the Georgia region the highest coefficient (.52) obtained for Stallings Island is with Kays I. The next highest (.49) is with the Ward site in Kentucky. However, coefficients of .40 or above were obtained with West Cuba, Ledbetter, Kays II, Chiggerville, Perry, Long Branch, and Big Sandy I. Since six out of nine high coefficients are with components that we have classified in the Eastern Tradition, we have considered that Stallings Island belongs in the same group. An estimated date for the beginning of the Stallings Island phase would be about 3500 B.C.

Conclusions

The results of the preceding discussion can be summarized in the following classification:

Midcontinent Tradition

Eva phase: 5200 B.C. to (?) 3500 B.C.

Three Mile phase: (?) 3500 B.C. to (?) 1200 B.C.

Big Sandy phase: (?) 1200 B.C. to (?) A.D. 1.

Indian Knoll phase: (?) 4000 B.C. to (?) 2000 B.C.

? phase: post-2000 B.C. includes Parrish, Ward, and the late component of Chiggerville.

Eastern Tradition

Stallings Island phase: (?) 3500 B.C. to (?) 1000 B.C.

Lauderdale phase: (?) 3500 B.C. to (?) 1000 B.C.

Kays phase: (?) 3500 B.C. to (?) 2000 B.C.

Weldon phase: 2000 B.C. to about 1200 B.C.

Ledbetter phase: (?) 1200 B.C. to (?) A.D. 500

It will be noted that there is no mention of Archaic manifestations in eastern Tennessee. The reason for this is our inability to identify any Archaic components there, although occurrences of Archaic type artifacts do suggest the former presence of peoples of that stage of culture.

Figure 7 is a chronological arrangement of the classification and a correlation with the climatic periods as indicated by radiocarbon dates or by the inferred effects upon local ecology. Since only six out of the 27 components have radiocarbon dates, most of the chronology is based upon the stratigraphy of certain key sites, the presence or absence of key traits, and the Z-coefficient analysis. Hence, in part, Figure 7 represents a series of hypotheses, particularly as regards the duration of the various cultural manifestations.

We have long argued for the extended duration of the Archaic (Kneberg 1954), an argument which seems to be reinforced by the radiocarbon dates. Considering the average date for Zones II and III of the Modoc Rock Shelter, 6219 B.C. ± 488 (Fowler and Winters 1956), Russell Cave, 7062 B.C. ± 350 (Miller 1958), and the late date for Kays II, 1625 B.C. ± 300, there is an indicated time span of approximately 5400 years. There seems to be no logical argument against the possibility that the Archaic stage of culture might have endured for another 2000 years. Evidence has been presented that Archaic peoples acquired many new culture traits, many undoubtedly through borrowing from peoples having other traditions, or even other stages of culture.

There seems little doubt that the Ledbetter phase endured well into the Christian era while still remaining an essentially Archaic culture. Gradual acculturation through contact with peoples of the Preformative and Formative stages finally erased the distinctions, at least in regions of the South where comparatively dense populations existed in later times.

We have already mentioned the pottery types associated with late Archaic components. It is quite likely that some of the late Archaic peoples actually began to make pottery, the

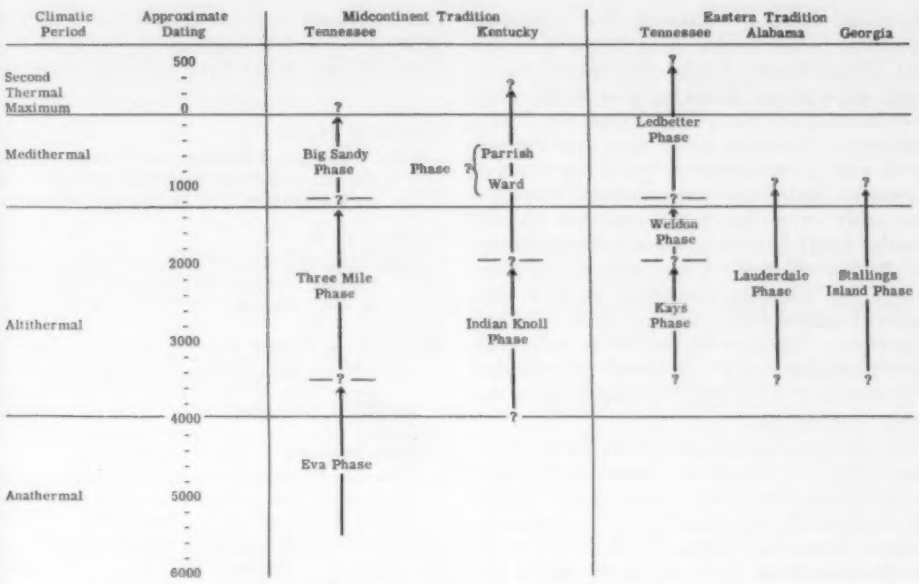

FIG. 7. Phases and traditions in the Middle South.

widespread, early, fiber-tempered pottery being an example. But, to pursue such discussion further would extend this paper beyond the scope of its original purpose. We believe that sufficient evidence has been presented to indicate that considerable interaction not only could have, but actually did take place between the Archaic and Woodland peoples.

Another possible relationship still remains to be considered, that of the Archaic to the Early Lithic stage. Of all the sites studied, only the Parrish site had a component that could be classified as belonging to the Early Lithic stage, although the Annis site produced two fluted points from the base of the midden. Webb (1951: 449) interpreted the material from the Parrish site as representing an early component having no connection with the subsequent Archaic occupation. We concur in Webb's interpretation, since the Parrish site is most closely related to components of the Big Sandy phase, particularly to the McDaniel site. As previously stated, we believe that the absence of mussel shell on this site, and the relatively small amount on the Ward site, suggest that these were sites of the Medithermal period. If this is true, there could scarcely have been a connection between the paleo-Indian and Archaic material on the Parrish site. This point has been raised because Thompson (1954) has suggested that a possible continuity between the early Lithic and Archaic stages was indicated at the Parrish site.

In our study of all of these sites, it was noted that regardless of the time period and the major fluctuations of climate, the ecology of the river bottoms was not greatly modified during the Medithermal. An exception may be noted in the case of mussels which are not represented in middens of that time. It seems probable that greater precipitation during the Medithermal merely made mussels less accessible to peoples of Archaic technology. However, during the Altithermal there must have been marked changes in the uplands even though the ecology of bottom lands remained fairly stable.

Adjacent to the valleys where the Archaic populations lived in Tennessee, Alabama, and Kentucky, is a physiographic feature known as the Highland Rim. This is an elevated region which is poorly watered. It is continuous on the north with the Pennyroyal District of the Interior Low Plateau which extends northward beyond the Ohio River valley. Today the flora of this province includes many relict prairie species such as the prairie cone flower, blazing stars, Indian grass, and prairie dock. The blackjack oak, post oak, and cedar, which

are found there, are types of trees that often penetrate former prairie land in the east central United States. Under Altithermal conditions, these prairie remnants were larger, more continuous, and less detached from the Prairie Peninsula (Transeau 1935) that now extends as far east as Pennsylvania, and as far south as Kentucky and Tennessee. Prairies were undoubtedly once far more extensive in the South. Royal E. Shanks reports recent botanical field work at the University of Tennessee which has disclosed numerous, isolated remnants of prairie flora communities in much of Tennessee. Furthermore, pollen from a peat bog in extreme eastern Tennessee has revealed a pronounced Altithermal influence upon the forest composition.

It is evident that people of the Early Lithic stage inhabited this upland region where many fluted points have been found (Lewis 1954). At least two Early Lithic habitation sites were located along the Tennessee River. One in northern Alabama is known as the Quad site (Soday 1954), and another in eastern Tennessee is known as the LeCroy site. Both of these sites were subsequently inhabited by Archaic peoples. The paleo-Indian occupations probably represent camping places which were periodically reoccupied for limited periods. To date, it has not been possible to demonstrate any continuity between Early Lithic and Archaic; however, the two groups may have been coeval to some extent.

The two groups reveal different patterns of ecological adjustment; the Early Lithic peoples were nomadic hunters and collectors, and the Archaic were sedentary hunters and collectors. The Early Lithic peoples probably hunted prairie fauna, while the Archaic peoples hunted forest fauna. The difference in their economy is not likely to have led to conflict between them, since they were not competing for either space or type of subsistence. If there was any interaction between them, it is not reflected in the cultural remains. Such similarities as exist in tool technology, for example, unifacial scrapers, merely indicate some remote, common, Old World tradition which was an antecedent of both cultures.

Summarizing the subject of possible interrelationships between Early Lithic and Archaic, it is our belief that the groups were coeval in part, but that there was little or no interaction between them. We can see no evidence of any developmental sequence or continuity between these two cultural stages in the area studied, although such might have occurred elsewhere.

CLAFLIN, W. H., JR.

1931 The Stallings Island Mound, Columbia County, Georgia. *Papers of the Peabody Museum, Harvard University*, Vol. 14, No. 1. Cambridge.

FAIRBANKS, C. H.

1942 The Taxonomic Position of Stallings Island, Georgia. *American Antiquity*, Vol. 7, No. 3, pp. 223–31. Menasha.

FOWLER, M. L., HOWARD WINTERS, AND P. W. PARMALEE

1956 Modoc Rock Shelter, Preliminary Report. *Illinois State Museum, Report of Investigations*, No. 4. Springfield.

KNEBERG, MADELINE

1954 The Duration of the Archaic Tradition in the Lower Tennessee Valley. *Southern Indian Studies*, Vol. 6, pp. 40–1. Chapel Hill.

1956 Some Important Projectile Point Types Found in the Tennessee Area. *Tennessee Archaeologist*, Vol. 12, No. 1, pp. 17–28. Knoxville.

KROEBER, A. L.

1940 Statistical Classification. *American Antiquity*, Vol. 7, No. 1, pp. 29–44. Menasha.

LEWIS, T. M. N.

1954 A Suggested Basis for Paleo-Indian Chronology in Tennessee and the Eastern United States. *Southern Indian Studies*, Vol. 6, pp. 11–13. Chapel Hill.

LEWIS, T. M. N. AND MADELINE KNEBERG

1947 The Archaic Horizon in Western Tennessee. *University of Tennessee Record, Extension Series*, Vol. 23, No. 4, *Tennessee Anthropology Papers*, No. 2. Knoxville.

MILLER, C. F.

1949 The Lake Spring Site, Columbia County, Georgia. *American Antiquity*, Vol. 15, No. 1, pp. 38–51. Menasha.

1958 Russell Cave: New Light on Stone Age Life. *National Geographic Magazine*, Vol. 113, No. 3, pp. 426–37. Washington.

NEILSON, W. A., T. A. KNOTT, AND P. W. EARHART (EDITORS)

1944 *Webster's New International Dictionary of the English Language*. Second edition. G. and C. Merriam Co., Springfield.

NEWMAN, M. T. AND C. E. SNOW

1942 Preliminary Report on the Skeletal Material from Pickwick Basin, Alabama. *Bureau of American Ethnology, Bulletin* 129, pp. 393–507. Washington.

PHILLIPS, PHILIP AND G. R. WILLEY
1953 Method and Theory in American Archeology: An Operational Basis for Culture-Historical Integration. *American Anthropologist*, Vol. 55, No. 5, pp. 615–33. Menasha.

QUIMBY, G. I.
1954 Cultural and Natural Areas Before Kroeber. *American Antiquity*, Vol. 19, No. 4, pp. 317–31. Salt Lake City.

ROUSE, IRVING
1955 On the Correlation of Phases of Culture. *American Anthropologist*, Vol. 57, No. 4, pp. 713–22. Menasha.

SODAY, FRANK
1954 The Quad Site. *Tennessee Archaeologist*, Vol. 10, No. 1, pp. 1–20. Knoxville.

THOMPSON, R. H.
1954 Archaic Cultures in Kentucky [Abstract]. *Southern Indian Studies*, Vol. 6, pp. 7–8. Chapel Hill.

TRANSEAU, E. N.
1935 The Prairie Peninsula. *Ecology*, Vol. 16, pp. 423–37. Brooklyn.

WEBB, W. S.
1945 Indian Knoll. *University of Kentucky Reports in Anthropology*, Vol. 4, No. 3, Part 1. Lexington.

1950a The Carlson Annis Mound. *University of Kentucky Reports in Anthropology*, Vol. 7, No. 4. Lexington.

1950b The Read Shell Midden. *University of Kentucky Reports in Anthropology*, Vol. 7, No. 5. Lexington.

1951 The Parrish Village Site. *University of Kentucky Reports in Anthropology*, Vol. 7, No. 6. Lexington.

WEBB, W. S. AND D. L. DEJARNETTE
1942 An Archaeological Survey of Pickwick Basin in the Adjacent Portions of the States of Alabama, Mississippi, and Tennessee. *Bureau of American Ethnology, Bulletin* 129. Washington.

WEBB, W. S. AND W. G. HAAG
1939 The Chiggerville Site. *University of Kentucky Reports in Anthropology*, Vol. 4, No. 1. Lexington.

1940 The Cypress Creek Village. *University of Kentucky Reports in Anthropology*, Vol. 4, No. 2. Lexington.

WILLETT, H. C.
1949 Long-Period Fluctuations of the General Circulation of the Atmosphere. *Journal of Meteorology*, Vol. 6, No. 1, pp. 34–50. Lancaster.

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CERAMIC PROFILES IN THE WESTERN MOUND AT AWATOVI, NORTHEASTERN ARIZONA

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ABSTRACT

Excavations in the Western Mound at this prehistoric Hopi pueblo provide 13 adjacent columns of refuse in masonry rooms which yielded 21,569 painted sherds. Stratigraphic analysis of these ceramic profiles has resulted in a relative chronology of five color classes of locally made painted pottery which will serve as a control for future ceramic studies at the site. Black-on-white, black-on-orange, and orange-paste polychrome were made from about A.D. 1200 to 1300 when they were abruptly replaced by black-on-yellow and yellow-paste polychrome. The differences between trash deposited in rooms and that dumped in the open, the anomalies of sherd and vessel quantities, and the well documented nature of this large sherd collection make possible observations on the problems of stratigraphic interpretation. Numerical comparison of painted sherds with vessels restored from them demonstrates the hazards of interpretation based solely on limited sherd samples. The fact that one of the rooms produced a sequence exactly the reverse of the situation in the other 12 rooms emphasizes the need for more extensive testing in room blocks than in trash dumps. Restoration of vessels from sherds found at different levels in different rooms shows the inadequacy of chronological inference based on stratigraphic position of unassembled sherds.

THE ARCHAEOLOGICAL DATA considered in this paper were collected by the Peabody Museum Awatovi Expedition to northeastern Arizona under the leadership of J. O. Brew, now Director of the Peabody Museum, Harvard University. The organization and objectives of the expedition have been stated by Brew (in Hack 1942b: v-vi).

The expedition conducted five years' field research, 1935–1939, under permission of the United States Department of the Interior, in the drainage of the Jeddito River, which lies partly in the Hopi and partly in the Navaho Indian Reservations, northeastern Arizona, between 35° and 36° N. Lat. The immediate area of investigation includes the Jeddito Valley, Antelope Mesa, Roberts Mesa, Tallahogan Valley, and Bluebird Canyon. Certain studies embrace the entire Hopi country and Black Mesa as a whole.

Twenty-one sites were excavated by the expedition, a site survey of the Jeddito drainage was made, and numerous specialized studies were undertaken. The field work was supported by the Exploration Fund of the Peabody Museum and by the liberal contributions of Mr. and Mrs. William H. Claflin, Jr., and Mr. and Mrs. Raymond Emerson, Mr. Henry S. Morgan, and Mr. and Mrs. Phillip Allen.

The Awatovi Expedition grew out of Mr. Claflin's interest in the prehistory of the Hopi country. During various trips to Northern Arizona he had acquired a thorough knowledge of the Reservation which has been of inestimable value to the Expedition. Faith in the archaeological possibilities of the Jeddito Valley led Mr. Claflin to instigate an extensive reconnaissance trip in 1935 which was followed by four seasons of intensive excavation. . . .

The excavated sites revealed remains of habitations of the region from early in the second half of the first millenium A.D. to the beginning of the 18th century. In terms of the Pecos Conference of Southwestern cultures, on the basis of architecture, pottery, and tree-ring dating, the periods represented were: Basket Maker III, Pueblo I, Pueblo II, Pueblo III, Pueblo IV, and part of Pueblo V.

The chief reason for the selection of Awatovi, instead of one of the other large ruined pueblos in the Jeddito, for major excavation was the apparent assurance, obtained in preliminary reconnaissance, that it held the longest record of occupation. Furthermore, that record was not restricted to prehistoric remains, for Awatovi was the site of the Franciscan mission of San Bernardo de Aguatubi and it is known from definite though meager historic references that the pueblo was still inhabited at the close of the 17th century.

It is generally assumed from the description given that Awatovi, although not mentioned by name, was the first of the Tusayan pueblos encountered by Tobar of the Coronado Expedition in 1540. Espejo visited Awatovi in 1583, and Onate in 1598. In 1629 the Franciscan mission was authorized, and from approximately that date until the Pueblo Rebellion in 1680 the inhabitants were in close contact with at least a few Europeans.

After the Rebellion twelve years elapsed before the Spaniards returned. In 1692 the "Moqui" pueblos, including Awatovi, were visited by de Vargas with a military expedition and once more fell under the influence of Christianity and European civilization. The re-acceptance of Spanish suzerainty and religion seems to have been more complete at Awatovi than in the other villages of Tusayan. This fact may have contributed to the eventual downfall of the town.

The nature of the abandonment of Awatovi is not very clear. At present, based on Hopi tradition and very limited references in contemporary official New Mexican documents, the following story can be pieced out. Sometime during the winter of 1700–1701 bands of men, probably recruited from the Hopi towns of First and Second Mesas (there is great disagreement in Hopi stories on this point), attacked the village and are said to have massacred the male inhabitants. As far as our information goes, this marked the end of Awatovi as an inhabited site. However, the unsatisfactory nature of this evidence is apparent, and the possibility of people living at Awatovi after 1701 must be considered. But we do know that at least one hundred and sixty years of life after the first Spanish contact lies recorded in these ruins.

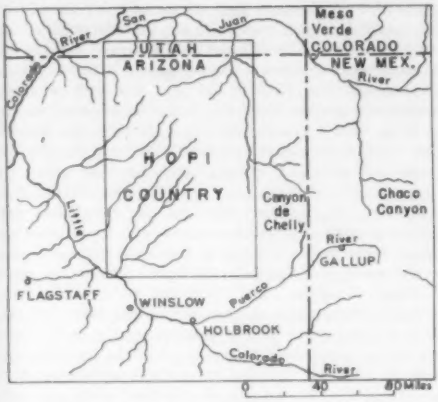

FIG. 1. Map of northeastern Arizona showing the location of the detail map in Figure 2.

The archaeological province (Fig. 1) thus characterized is of exceptional interest in that the inhabitants continued to live and maintain substantial villages during the 14th and 15th centuries in a region where their Pueblo neighbors in surrounding districts abandoned their villages permanently. At first encounter today, the Hopi landscape appears much less hospitable than some of the adjacent districts that were deserted, but as Hack (1942a) has demonstrated, the Jeddito and other valleys along the southern escarpment of Black Mesa have sufficient water resources to permit survival of farm communities during periods of drought. With coal for fuel in a district of scrub vegetation, rainfall stored in sand dunes to feed fresh water springs, and valley floors suited to flood water irrigation, the prehistoric inhabitants managed no less well than the present-day Hopi have done since the Spanish Conquest.

Because of this long interval of occupation, the pottery from the ruins in the Jeddito valley offers opportunity for studies of chronology and culture history with broad application throughout the Pueblo region. After a lapse of several years, the intensive study of this pottery is being carried forward. Because the total quantity of pottery collected by the expedition was so large, the decision was made to begin with a manageable fraction of the painted pottery; the choice being the black-on-white, black-on-orange, and orange-paste polychrome pottery of late Pueblo III age at the site of Awatovi. These, together with the black-on-yellow and associated yellow-paste polychromes constitute the five color classes stratigraphically associated in the central rooms of the Western Mound, the oldest structure, so far as known, in the prehistoric village.

This material was selected for initial study for two reasons. First, the manufacture of these color classes continued after the pueblo population in the San Juan river country had abandoned their settlements forever. For that reason, the ceramic stratigraphy in the Western Mound permits a correlation of the desertion of the San Juan region with the continuing pueblo occupation in the Little Colorado river country. Second, the ceramic profiles in the Western Mound serve to establish a reliable chronology for subsequent study of the larger mass of pottery from the later Pueblo IV and V levels at Awatovi, as well as from other ruins in the Hopi country. The stratigraphic associations and the relative chronology of these five color classes of pottery are presented here as one of the initial results of the current ceramic study, which is being done under the direction of Watson Smith,

FIG. 2. Map of the Jeddito region showing the location of Awatovi.

Curator of the Archaeology of the American Southwest, Peabody Museum, Harvard University. This phase of the work is being done in the archaeological laboratory at Tucson, Arizona, which has come to be known as the "Peabody Museum West of the Pecos."

Excavations in the Western Mound

The site of Awatovi occupies about 20 acres on the southern tip of Antelope Mesa, between Tallahogan Wash and Jeddito Wash (Fig. 2). Between the brink of the cliff on the south and west sides and sand dunes to the north and east, the entire site is a mass of ruined pueblos, one to three (possibly four) stories high, and in the east sector, the remains of Spanish churches and other postconquest buildings. The excavations which concern us here were undertaken in 1936 in the Western Mound, which was the first pueblo structure to be built on the site in prehistoric times. The results of the field work in that season have been described elsewhere by Brew (1937). In the present context, therefore, a brief summary of field activities will suffice.

In 1936 a standard grid of rectangular coordinates was established over the entire site for plane table mapping, with elevations referred to a standard datum. The primary bench mark was established in a bedrock exposure within the confines of the site and whenever possible the intersections of grid coordinates were marked by brass bench marks set in concrete in the bedrock. This control permitted systematic location, in plan and depth, of structures, burials, artifacts, and other cultural remains in the ruins. Consequently all the thousands of potsherds from the site can be studied with reference to their original location and depth anywhere among more than 1000 rooms and other excavated areas at elevations from surface level to a maximum depth of about 7 meters.

Field observations of the excavations were recorded by J. A. Lancaster. To maintain vertical control, rooms and other structures were excavated by levels which were at all times referred to the constant elevation of the site datum. In deposits of undefined trash and earth, the levels were usually 50 cm. (19.7 inches) deep. Many of the levels were less than 50 cm. deep because they were terminated whenever a floor or special structural feature was encountered. After each of these floors was cleared, recorded, and removed, a new level was begun underneath it. A few of the levels on the steeply-sloping surface of the Western Mound were as much as a meter deep on the higher side.

Field and laboratory records of pottery were made by Mrs. Harriet S. Cosgrove. Sherds and other specimens were identified at the excavations by room number and

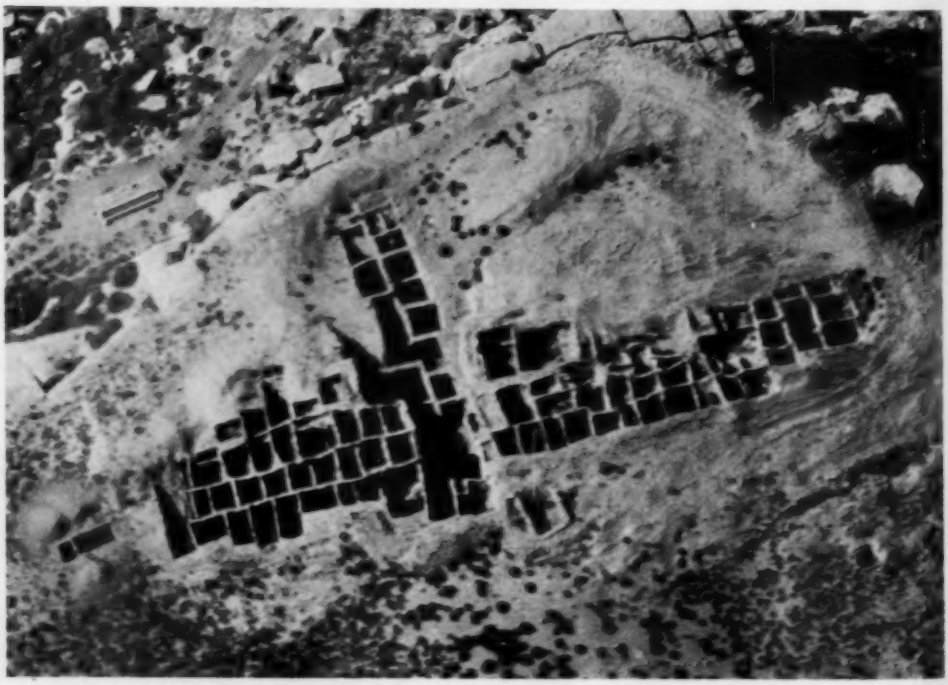

Fig. 3. Aerial view of the Western Mound at Awatovi, looking south, 1936.

level. Each lot was separately processed, and after the sherds were washed they were sorted into the color classes here described. Plain sherds and corrugated sherds were segregated into unpainted categories. All specimens were catalogued in the field to preserve provenience by room and level, and at Cambridge a permanent catalogue number was added.

Sherds from the central rooms described here were counted in the field and all of them below the uppermost levels were saved without selection. Since then, again without selection, all the black-on-white, black-on-orange and associated polychrome sherds and vessels have been shipped to Tucson. Also at hand are the relatively few exotic specimens, comprising "trade pottery" and local oddities. Together with these is an adequate sample of black-on-yellow sherds from the upper levels, as well as all those sherds which, in the field, exhibited the slightest variation from the standard character of Jeddito Black-on-yellow.

The Western Mound extends about 70 m. east-west and 40 m. north-south, with a total number of ground-floor rooms estimated to be 200 to 250 (Fig. 3). The height of the remaining standing walls increases from a single course of masonry in rooms along the cliff, where most of the original structures have eroded away, to a maximum height of about 7 m. at the center of the mound. Along the east-west axis, 89 rooms (including irregular enclosures and three rectangular kivas) were excavated to the depth of the first floor below the surface. At the west end of the mound, 14 rooms were excavated to bedrock. At the center of the mound, 28 rooms and masonry enclosures were excavated to bedrock, and it is the deepest of these that provide the data for the present study (Fig. 4).

Excavation of the central rooms began on the south side of the mound, at bedrock level along the edge of the cliff (Fig. 5). Digging proceeded northward through a double row of rooms for a distance of 26 m. to the heart of the mound, where the walls rise from bedrock to a height of 6.7 m. No kivas, either round or rectangular, were encountered in this central cut.

The bedrock surface is virtually level, having a rise of only 1% from the cliff northward. Most of the massive ground-floor walls rest directly on the sandstone. A few are footed on red sand that formed a compact subfloor foundation, 20 to 35 cm. thick, in all the rooms. A few instances in which cross walls were built on refuse at a considerable height above bedrock are specifically mentioned later. The layer of red sand (Figs. 6, 7, Level n) was evidently carried in as foundation material when the first

FIG. 4. The central rooms in the Western Mound at Awatovi, looking south, 1936.

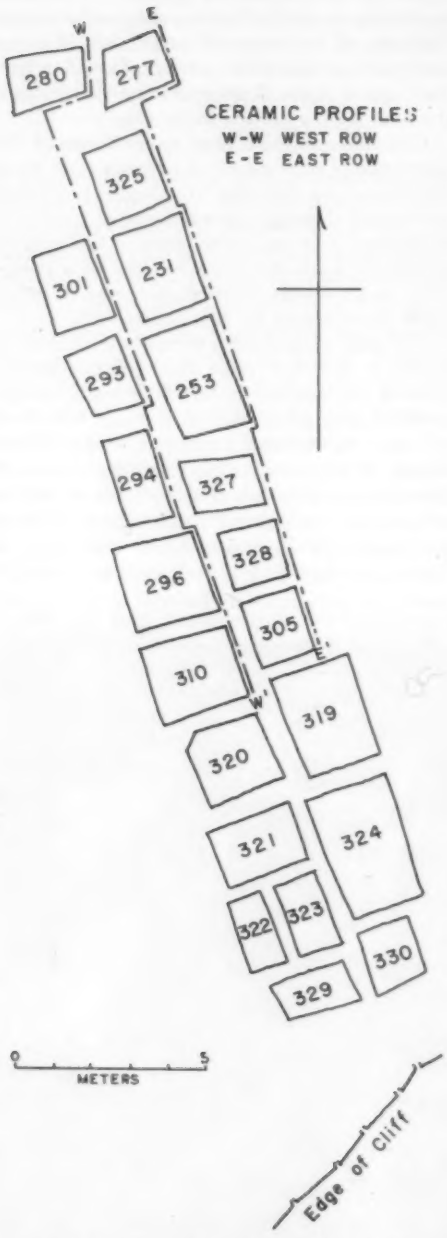

Fig. 5. Floor plan of the central rooms in the Western Mound at bedrock level showing the location of the ceramic profile lines.

rooms were built. As the sherd count shows (Fig. 9), Level *n* was virtually sterile in all rooms except Room 231.

In the interior rooms, walls of double-stone thickness rise to a nearly uniform height of 3.1 m. above bedrock. Above this level, the walls are narrower, usually single-stone in thickness. Some of the surface walls are offset from those below to form smaller rooms or irregular inclosures. These modifications in construction can be more clearly visualized by reference to the perspective sketches of the central rooms (Figs. 6, 7).

As the sketches show, the lower rooms served very much like stone-lined wells for the dumping of trash. Isolated thus, at bedrock level, they constitute 13 columns of archaeological debris joined like cells in a hive, yet each having its own more or less separate ceramic history. As shown in Figure 9, three of these columns (Rooms 293, 294, and 301) join at higher levels to form a single column, designated Area Y. In a second instance, two columns join to form one, Area X. In a third instance, two rooms that might be combined at lower levels are shown as separate columns. These are rooms 277 and 280. From Level *h* down to bedrock, 3.6 m. below, there was no dividing wall between these columns of refuse. The two rooms, however, were excavated and recorded separately and our profiles are drawn to conform to the field data. Inasmuch as these twin profiles represent equal volumes of refuse, they permit comparison of the ceramic content of two adjacent stratigraphic columns in what is presumably a homogeneous mass of refuse.

In the accompanying charts and profiles, the vertical scale indicates the depth, in meters and feet, of floors and excavation levels measured downward from the top of the mound. Zero elevation represents the highest elevation of the Western Mound, the summit of which is about 8 m. north of Room 280. Level *a* on the profiles is the fractional meter of refuse at the surface, with a maximum depth in Rooms 277 and 280 of 75 cm. Below this fractional meter, Levels *b* through *m* designate 50 cm. layers (more or less) down to the sand layer, Level *n*. Correspondingly designated levels in the different rooms vary as much as 15 cm. above or below the meter and half-meter intervals of the vertical scale. Shallower levels, less than 50 cm. thick between floors, have been given supplementary designations: for example, *k 1* and *k 2*

together have an approximate depth of 50 cm., conforming to the *k* levels in the other rooms.

COMPOSITION OF THE TRASH DEPOSITS

When the Western Mound was an inhabited pueblo, the occupants disposed of kitchen trash and other household debris within the walls of abandoned rooms, and not, as might have been expected, over the edge of the cliff on the south and west sides. As Brew (1949: 52–3) has explained, the principal reason for this practice may have been the force and direction of the prevailing wind. With a daily sweep from the southwest, the wind drives loose earth, trash, and coarse sand across the surface of the mound. For the prehistoric inhabitants, who lived so much out of doors on the housetops and in the courtyards, dust was a sufficient nuisance without the stifling and corrosive addition of coal ashes. Thus, although the debris in the central rooms varies somewhat in composition and content, the evidence of deliberate trash disposal there is convincing for all except the surface levels. On the surface slope of the mound, for a depth of a meter or so, the original placement of the room contents has been disturbed by collapse of walls and subsequent sliding toward the cliff.

None of the interior rooms were damaged by fire, and the massive walls have stood without radical slumping or collapse. No consequential disturbance or inversion of strata by animal burrows or by prehistoric excavation for storage pits was observed. No burials were found in the central rooms. The character and composition of the refuse indicate that whenever any of the floors in these rooms were abandoned as living quarters, the deposition of trash continued without subsequent inversion.

Two reasons for this stable condition of room debris are apparent. First, the pueblo was built on a level sandstone surface instead of soil; consequently there was no mixture of cultural debris with any structures or artifacts earlier than the date of first construction of the massive walls of the central rooms. Second, the walls of the original group of rooms appear to have been built contemporaneously and as a unit at bedrock level and have retained their stability to the present day.

The condition of the pottery in the central rooms offers further evidence of deliberate disposal of trash. Except for a few ladles and miniature jars, all the pottery was broken, and no bowls or jars were found intact on the floors or elsewhere in the fill. Restorable vessels, moreover, were not found with all their shattered fragments clustered together; but were assembled from sherds scattered widely through the fill. Scarcely any of the restorable jars or bowls were identified as such during excavation, and the condition of sherds and artifacts on the floors was as nondescript as anywhere else in the refuse.

With few exceptions, also, the restored vessels were incomplete, as we have determined by systematic search through the thousands of sherds from the lowest 4 m. of refuse in the central rooms, despite the fact that all the sherds from these levels were saved and subsequently shipped to Tucson. Even the largest jars, represented by 50 to 200 painted sherds, were seldom more than one-half to two-thirds complete. The presence of matching sherds from different rooms suggests, however, that other fragments of these vessels may be present in adjoining rooms that were not excavated below the level of the uppermost floors.

Stone artifacts were scarce below the upper levels of the central rooms, and those that were collected there were worn-out or broken (Woodbury 1954). The condition of the pottery and other artifacts suggests that few portable objects of value were left in these rooms after they were abandoned as living quarters.

Architectural features further indicate deliberate use of the rooms for trash disposal. Many floors were found to be slumped and broken. No remnants of ceiling timbers, burned or unburned, were found in the lowest three meters of refuse, and their absence points to intentional removal for later construction elsewhere in the pueblo. Displacement resulting from the slope of "natural" strata was inconsequential. At the time of excavation, the occurrences of sloping strata were noted and recorded (Brew 1937), but in the few instances observed, none dipped to any significant degree below the horizontal levels arbitrarily followed for excavation. With the exception of Room 253, which is 3 m. long, all the rooms discussed here were about 1.5 to 2 m. square (5 to 7 feet on a side) and there was little space in them for the formation of steeply inclined strata.

In summary, the excavations yielded no evidence of any radical disturbance or inversion of the levels of refuse in the 13 stratigraphic columns. Consequently, these columns provide

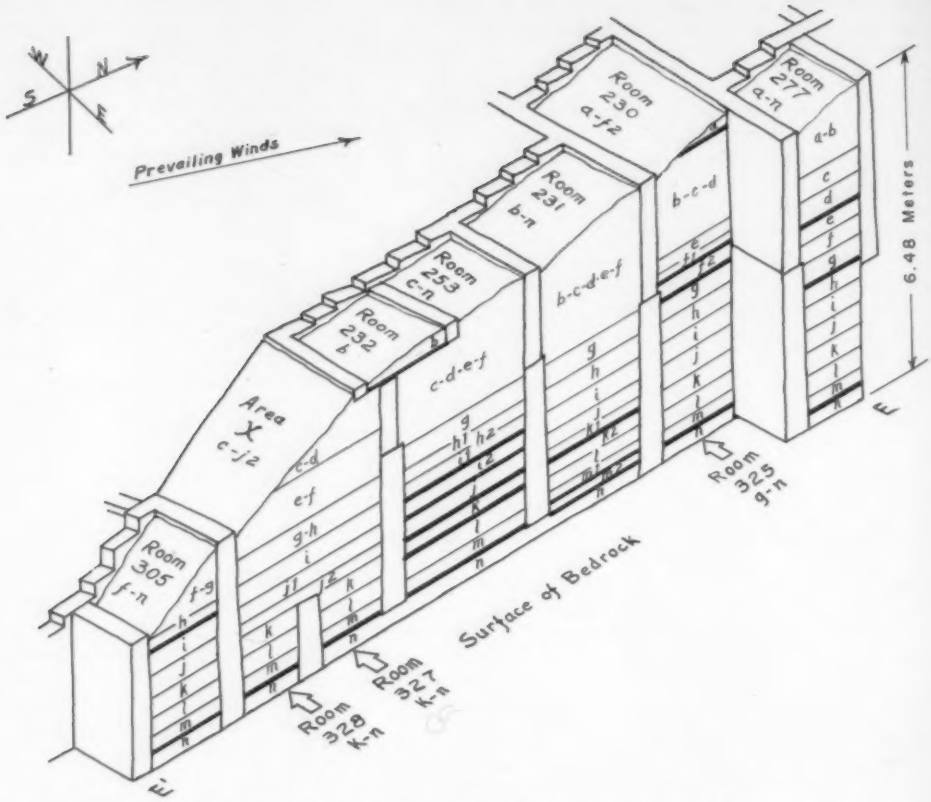

Fig. 6. Isometric sketch of ceramic profile columns, east row of central rooms, Western Mound, Awatovi, looking northwest.

an unusually favorable opportunity for the solution of some of the essential problems inherent in a long ceramic record: first, establishment of the differential rate of deposition in the various rooms, and second, determination of the time level of earliest occurrence and the subsequent time span of each of the five color classes of pottery. If reasonable solutions to these problems can first be provided, subsequent and more detailed study of pottery types and varieties should yield a more refined chronology and more trustworthy historical and cultural inferences, both local and regional.

Some Problems of Stratigaphic Interpretation

At Awatovi, the central rooms provide the data for establishing a local ceramic chronology. Not only are these rooms very deep, but they also contained an adequate quantity of painted pottery in all levels. From previous archaeological studies in the Hopi country it is known that the painted pottery in the Western Mound has a time span of two centuries or more, beginning about A.D. 1200. A terminal date of 1400 or a little later is indicated by the presence of sherds of Sikyatki polychrome in surface levels on the highest part of the mound. The first appearance of the Sikyatki style, which originated locally when red pigment was added as a second design color to Jeddito Black-on-yellow, apparently coincided with the abandonment of the Western Mound as an inhabited pueblo.

The merits of an internal ceramic chronology may seem to be self-evident, but at the risk of stating the obvious, the purpose of this analysis can be most easily explained by considering

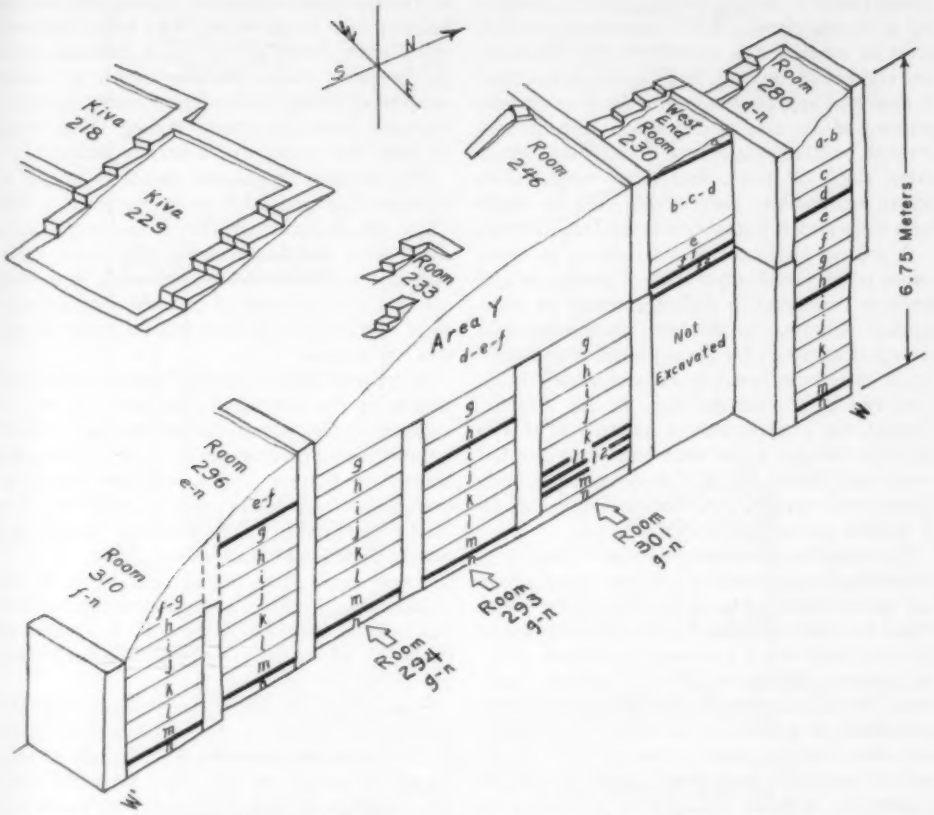

FIG. 7. Isometric sketch of ceramic profile columns, west row of central rooms, Western Mound, Awatovi, looking northwest. Position of Kivas 218 and 229 indicated only by outline of walls at surface of mound.

a few of the interpretive problems of pottery association as observed in trash deposits contained within the walls of large pueblo ruins.

It is important, first of all, to recognize that trash deposits confined in rooms show some conspicuous differences from trash deposits that occur on open ground outside pueblo walls. Among these differences the most significant one to be considered here is the differential rate of accumulation, as indicated by variable depth of occurrence of contemporaneous potsherds in different rooms. In the Western Mound at Awatovi these occurrences are represented not only by the same types of potsherds, but by 38 vessels restored wholly or in part from sherds found in different rooms.

As a hypothetical example of varying rates of deposition, consider an inhabited pueblo with two interior ground-floor rooms no longer usable for residence or storage. These rooms become convenient dumping places for kitchen trash and broken or worn-out pottery and artifacts. In time they fill up with consolidated rubbish, but they may not fill at the same rate or necessarily become stratified with perfect textbook elegance. Consequently, sherds from a single vessel may be scattered in both rooms and may be separated in vertical depth by as much as a meter. If we followed an interpretation based strictly on stratigraphy we might draw from this evidence the absurd conclusion that fragments of the same vessel differed in age by half a century.

In such a situation, it becomes apparent, therefore, that specimens of trade pottery found at various levels cannot be used as absolute

dating fossils or horizon markers strictly according to metric depth. Each trade item, instead, must be evaluated in relation to the character and content of the trash layer in which it occurs. A judicious appraisal of metric depth must take account of the rate of deposition, disturbances through building alterations, or collapse of structures, slope of strata, and other irregularities before trustworthy correlations can be made with ruins and cultures outside the local district.

A second character of importance in room refuse is the variable quantity of potsherds and artifacts contained in different rooms of comparable volume. At Awatovi these variations are very instructive for the appraisal of archaeological inferences based upon numerical tabulations and descriptive statistics. In the Western Mound, the irregularities in quantity of sherds per unit volume focus attention upon the extreme and bizarre effects of sheer accident, both human and natural, involved in the deposition of broken pottery and other artifacts.

The variable quantity of artifacts serves also to emphasize a distinction between room refuse and sheet refuse on open ground. After sheet refuse has been deposited outside pueblo walls, and the pueblo itself has been abandoned, natural agencies continue to shift the position of artifacts. In contrast to such deposits in which the movement of artifacts is not impeded by walls and other barriers, trash contained in the deep central rooms of a large pueblo may rest almost indefinitely without disturbance following its original deposition. When these rooms are excavated, irregularities in sherd quantity will be found essentially as they existed when the deposits were sealed in, whether by the inhabitants during residence or by natural agencies after the pueblo had been abandoned.

When we attempted to make a conventional analysis of the stratigraphy of the Western Mound, these questions of archaeological inference soon modified our plans for an orthodox study of pottery types, wares, and styles. At the outset we encountered two major difficulties in the manipulation of records and specimens. These were, first, the anomalies of sherd quantities in relation to estimated numbers of vessels represented, and second, stratigraphic variation in different rooms.

Anomalies of Sherd and Vessel Quantities

The first difficulty arose in the course of the initial gross sorting of sherds into color classes at Tucson, when it became apparent that sherds belonging to single vessels had been deposited in different rooms as well as in different levels in the same room. As the sorting of sherds continued, many restorable vessels gradually emerged from the mass; among them being 38 from the central rooms here considered.

The number of painted sherds belonging to a single vessel ranged from two or three to 198. Thus, in contrast with sherds-as-pottery types, there were sherds-as-vessels, with great variation in number of sherds-per-vessel. It seemed obvious that a count of painted sherds might yield conclusions different from a count of vessels represented.

In order to make a detailed analysis of painted sherds in the central rooms, each of the 13 ceramic profiles was separately graphed to show quantities and percentages for each of four color classes of pottery: black-on-white, black-on-orange, black-on-yellow, and polychrome. The further separation of polychrome sherds into orange-paste and yellow-paste classes (Figs. 9, 11) was made after re-examination of all the polychrome sherds. The results of this reclassification of polychrome sherds is shown in Figure 11, where the early and late polychromes are separately graphed.

Examples of the preliminary laboratory graphs of two individual rooms are shown in Figure 8. The number and percent of each of four classes of sherds are tabulated for each level. The breadth of each bar graph, although not precisely to scale, is roughly proportional to the quantity of painted sherds. The area of Room 253 is 6 sq. m. and the volume of each 50 cm. level is about 3 cu. m. Room 231 is 4 m. square and the volume of each 50 cm. level is about 2 cu. m.

The ceramic data on these two rooms are illustrated in detail because, in the lower levels, their sherd content presents a striking contrast between number of sherds and minimum number of vessels identified. As shown in Figure 6, these rooms stand side by side in the east row. The wall between them did not extend all the way down to bedrock, but rested instead on the red sand fill, about 30 cm. thick. Special attention was given to Levels *l*, *m*, and *n* in these rooms when we observed first that hundreds of black-on-white sherds belonged to relatively few large jars.

The bedrock levels in these rooms demanded attention for other reasons, also. They represent

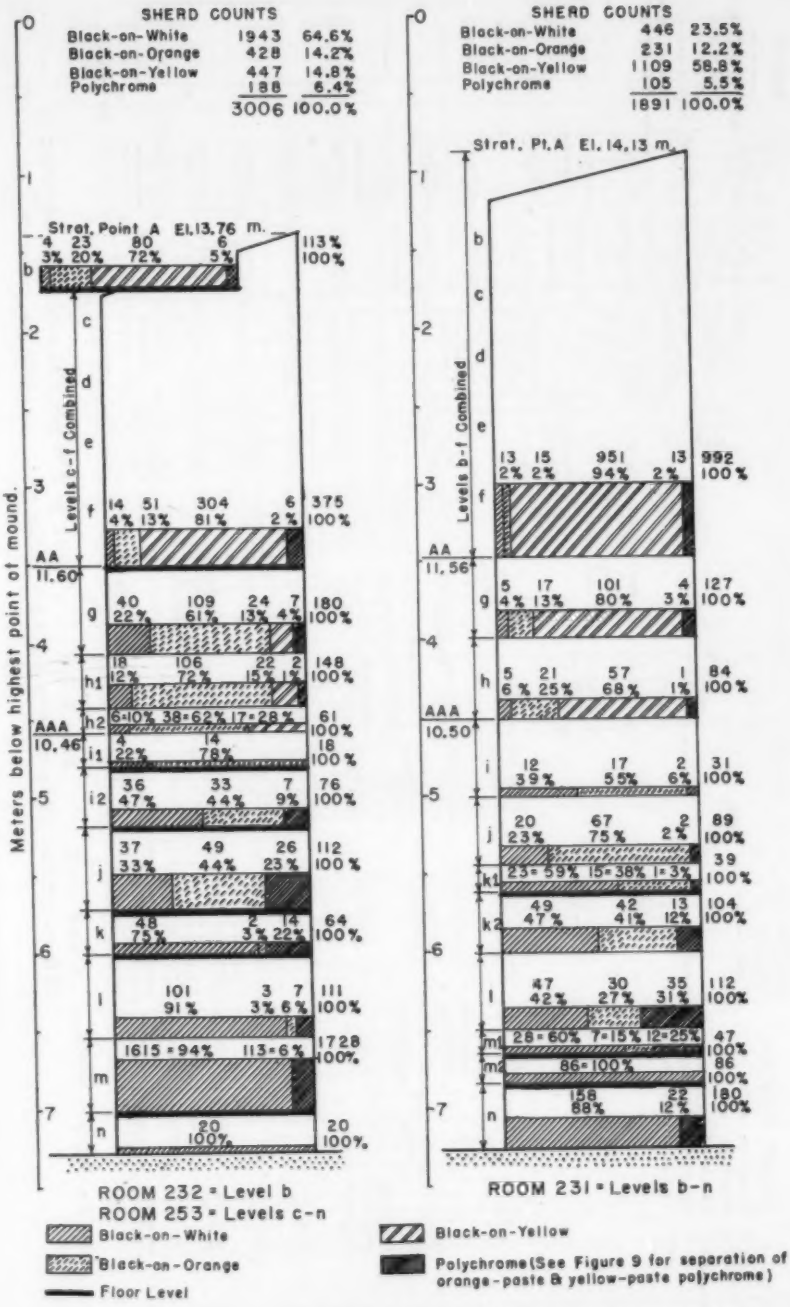

FIG. 8. Graphic summations of individual ceramic columns prepared for preliminary analysis of painted sherd quantities and percentages.

NORTH
Zero Elevation, Top of Mound, 15.0 Meters above datum, 8 Meters North of Room 280.
BEDROCK
COLOR CLASSES
B/W Black-on-white
B/O Black-on-orange
B/Y Black-on-yellow
O-P Orange-paste polychrome
Y-P Yellow-paste polychrome
Floor Level
Meters below top of mound
305 f-n 310 g-n 296 e-n
Area X c-j 2
328 k-n 327 k-n 294 g-n 293 g-n 301 g-n
Area Y b-f
232 b 231 b-n 230 a-f2 277a-n 280 a-n
253 c-n
325 g-n

FIG. 9. Quantities of painted sherds in 13 ceramic profiles, central rooms, Western Mound, Awatovi.

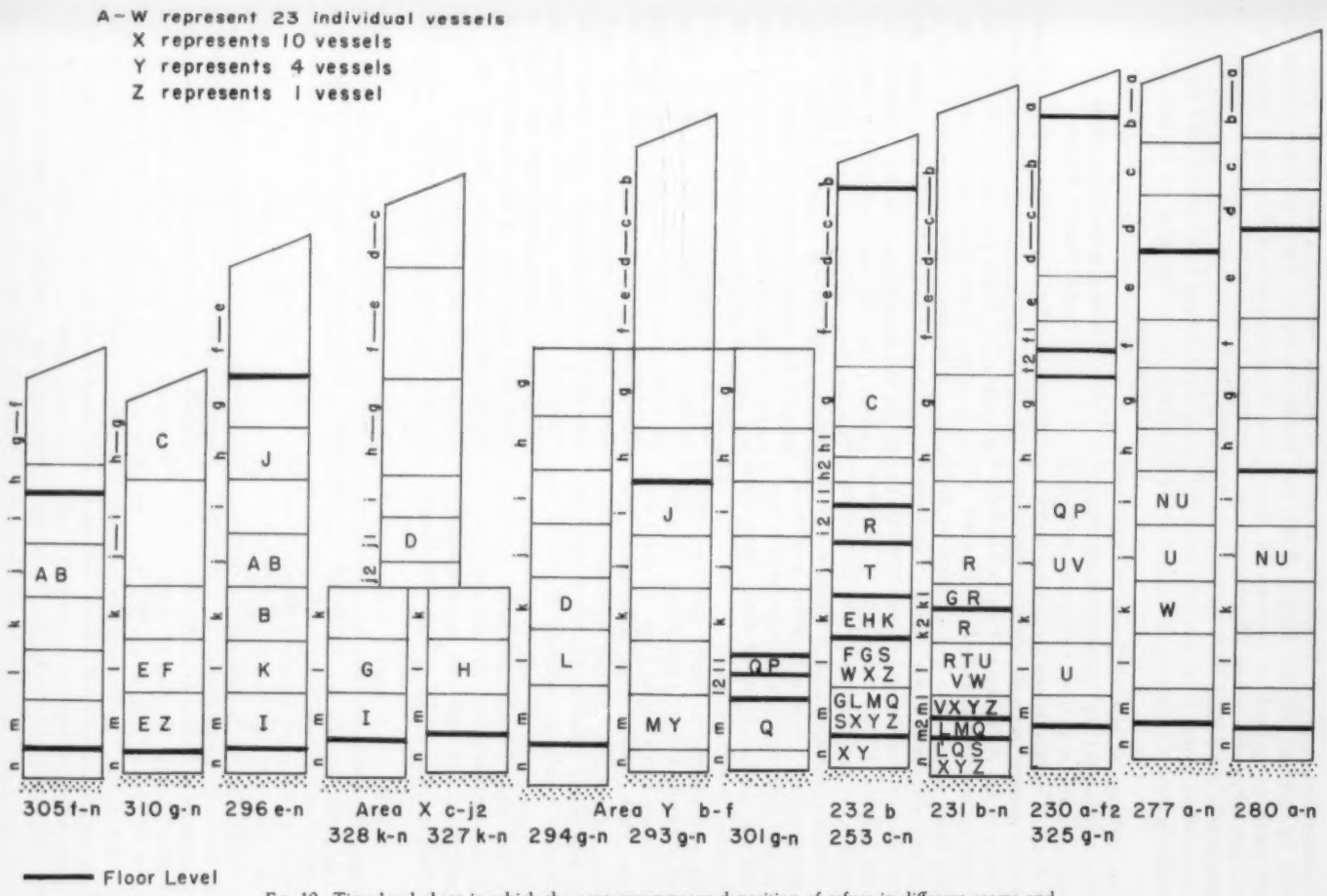

FIG. 10. Time-level chart in which the contemporaneous deposition of refuse in different rooms and levels is shown by the presence of matching sherds of restored vessels.

the earliest occupation at Awatovi, as demonstrated by test excavations carried down to sterile earth or bedrock at intervals of about 50 m. throughout the entire 20 acres of ruins. Consequently, the pottery from the lower levels of the central rooms is of primary value for establishing control of ceramic succession at the site .

Our estimate of the minimum number of vessels represented by painted sherds from Levels *l*, *m*, and *n* in these two rooms is listed in Table 2. The tabulations are limited to color classes of pottery, without specific assignment to pottery types. As shown in Figures 9 and 11, the distinct and chronologically later class of Jeddito Black-on-yellow is absent; hence we are concerned with only three classes: black-on-white, black-on-orange, and orange-paste polychrome. Table 1 lists the count of painted sherds by room and level and Table 2 the number of vessels estimated after restoration. Table 3 summarizes the contrast between number of sherds and estimated minimum number of vessels for the combined lots of sherds from the three levels in both rooms.

Our own attempt to reduce sherds to vessel counts confirms Krieger's experience with pottery from the Davis site in Texas (Newell and Krieger 1949: 75–7). Our observations also confirm his conclusions about statistical distortions that result when undecorated fragments of painted vessels are counted separately as "types" of plain ware. We concur with his statement that "what is needed, primarily, is to leave plain body sherds out of the statistics."

For comparison with the vessel count just described, a few estimates of minimum number of vessels were made for sherds from other rooms and levels. These estimates indicate only that the proportions of sherds and vessels listed in Table 3 cannot be accepted as average for all levels and rooms in the Western Mound; they serve instead to emphasize the erratic circumstances of deposition of broken and discarded pottery.

Stratigraphic Variations in Different Rooms

Inspection of the sherd data in Figure 9 shows that no two of the ceramic profiles are identical in number of sherds per unit volume of refuse or in metric depth of occurrence of each color class of pottery. This circumstance leads to a problem of archaeological significance: that is, the interpretation of ceramic stratigraphy in pueblo ruins that are incompletely excavated. This problem can be most easily illustrated by referring here to the ceramic profiles. Let us assume, for example, that the Western Mound had been "tested" by excavation only of Room 231. The resulting stratigraphic record would have corresponded to a test pit dug in a trash deposit on open ground. If none of the adjoining rooms had been excavated, the conclusion would have been drawn that Jeddito Black-on-orange pottery, contemporaneous with black-on-white, was being made when these rooms were first occupied, and furthermore that the orange-paste polychromes were not made or used until some years or decades later. But, as can be seen by reference to Figure 9, that conclusion is the exact reverse of the state of stratigraphic occurrence determined by comparison

Table 1. Count of Painted Sherds in Rooms 231 and 253.

Room	*Level*	*Thickness of Level*	*Cubic Meters in Level*	*Black-on-white Sherds*	*Black-on-orange Sherds*	*Polychrome Sherds*
253	l	58 cm.	3.5	101	3	7
	m	45 cm.	2.7	1615		113
	n	25 cm.	1.5	20		
	Subtotal			1736	3	120
231	l	50 cm.	2.0	47	30	35
	m1	15 cm.	0.6	28	7	12
	m2	12 cm.	0.5	86		
	n	47 cm.	1.9	158		23
	Subtotal			319	37	70
	Total			2055	40	190

TABLE 2. ESTIMATES OF VESSEL QUANTITIES IN ROOMS 231 AND 253.

Source of Sherds	Color Class	Vessel Form	Sherds Assigned to Vessels	Unassigned Sherds	Minimum Vessels Represented
Rooms 253 and 231 combined	Black-on-white	Jars	1758		19
		Bowls			
Levels l, m, n	Black-on-orange	Jars			
		Bowls			
	Polychrome	Jars	2		1
		Bowls	61		2
Room 253 only Levels l, m, n	Black-on-white	Jars	37	46	33
		Bowls	99	51	48
	Black-on-orange	Jars			
		Bowls	1	2	1
	Polychrome	Jars			
		Bowls	79		11
Room 231 only Levels l, m, n	Black-on-white	Jars	29	17	8
		Bowls	9	9	6
	Black-on-orange	Jars	8	6	8
		Bowls	17	6	17
	Polychrome	Jars	1		1
		Bowls	47		24

Plain bottom sherds omitted.
Bowl-sherd count includes ladle and dipper fragments.

with the 12 other ceramic profiles in the central rooms.

The foregoing remarks about archaeological inference and analytical methods, as exemplified at Awatovi, have been stated to explain why our initial effort has been to establish an internal ceramic chronology. Our present observations indicate that if we had tried first to develop a chronology by recourse to trade pottery and other extraterritorial inferences, we might have erred by as much as half a century in dating stratigraphic levels.

CONCLUSIONS

Our analysis of ceramic stratigraphy in the Western Mound has been undertaken to establish an internal chronology to serve as a skeleton for more detailed and specialized studies of pottery decoration, technology, and forms, and the formulation of phases or periods of occupation at the site. Inasmuch as the ceramic profiles are local in significance, our conclusions are limited to topical summaries of methods and results, some of which have already been stated or anticipated, more or less piecemeal, in the preceding description.

Interpretation of Sherd and Vessel Counts

One of the essential requirements for a reliable study of potsherds is an adequate sample. However, the enumeration of sherds by room and level (Fig. 9) shows that abundance is not the only essential for satisfactory interpretation. Extremes of variation in number of sherds (10 to 600 per cu. m.) occur in refuse which, at the time of excavation, appeared to be a virtually homogeneous mass of earth constituents in all the rooms. Here we have no regularity in quantity or rate of deposition to correspond, let us say, to the seasonal deposition of clam shells in a kitchen midden.

Apart from the variation in number of sherds per unit volume is the proportion of sherd quantities to the number of vessels from which they are derived. If we consider only the decorated portions of vessels, broken into fragments that are run-of-the-mill in size, we can estimate the number of painted sherds per vessel as

Table 3. Contrast of Sherd and Vessel Counts in Rooms 231 and 253.

Rooms 231 and 253, Levels l, m, n, Combined	*Black-on-white*		*Black-on-orange*		*Polychrome*	
	Jars	Bowls	Jars	Bowls	Jars	Bowls
Sherds assigned to vessels	1824	108	8	18	3	187
Sherds unassigned	63	60	6	8		
Sherd totals	1887	168	14	26	3	187
Minimum number of vessels	60	54	8	18	2	37

Plain bottom sherds omitted.
Bowl-sherd count includes ladle and dipper fragments.

follows: ladles — two to ten; bowls — five to 30; jars — 25 to 200. But as shown in Table 2, an overwhelming majority of jar sherds may represent a relatively small number of jars. In view of the fact that few of the restored vessels were anywhere near complete, it is hazardous to use these data to compute the original percentages of the various vessel forms in use when the Western Mound was an occupied pueblo, or to estimate their prevalence in terms of the number of unrestored sherds that may be collected in a trash deposit.

A further difficulty of interpreting sherd quantities is encountered when pottery types are tabulated as percentages of the total number of sherds collected. Referring again to Table 1, a total of 2285 painted sherds was collected in Levels *l*, *m*, and *n*, Rooms 231 and 253. Of this number, we can tentatively classify 1318 black-on-white sherds as specimens of three closely similar pottery types in the Museum of Northern Arizona Handbooks, namely, Betatakin, Tusayan, and Kayenta black-on-whites. But all of these 1318 sherds are fragments of 11 jars restored at Tucson. Thus, 57.7 % of the sherds from these levels are assignable to three contemporaneous pottery types distinguished from one another principally by variations in elements of decoration. The remaining 42.3 % of the total of 2285 sherds represent an estimated minimum number of 168 jars, bowls, and ladles, including black-on-orange and orange-paste polychrome vessels as well as black-on-white. Among these 967 sherds at least a dozen pottery types can be identified by the criteria of the Museum of Northern Arizona Handbooks.

We are unable to suggest a useful formula for converting sherd counts to vessel counts. Some archaeologists in the Southwest follow the practice of counting a restored or intact vessel as a single item, having the same numerical significance as a single potsherd. This practice, however, is not wholly satisfactory for comparison with pottery from sites in which sherds are counted without attempt at restoration. Under these circumstances, the calculated percentage of a specific pottery type in a collection of sherds cannot be construed as a scientifically precise index of cultural content. The interpretation of such data requires consideration of various alternative explanations for the occurrence of the pottery type in question.

As an expedient, the percentage of pottery types might be adjusted or weighted by rating jar sherds differently from bowl and ladle sherds. If this were done by rating five jar sherds equal to one bowl or ladle sherd, it is obvious that the percentages of pottery types would be radically altered. However, our experience with the pottery from the Western Mound has convinced us that no such arithmetical device can compensate for the accidental causes of irregularity in sherd quantities.

In our analysis, we have not ventured beyond descriptive statistics into interpretive manipulation of the data. We are of the opinion that more sophisticated statistical treatment is not warranted, and might indeed yield erroneous conclusions. We have, however, tabulated the available data in Figure 9. Thus, the reader can more justly compare our methods with others that have been or might be used to decipher ceramic stratigraphy.

The pitfalls of statistical interpretation can be illustrated by example. When black-on-yellow pottery supplanted black-on-white and black-on-orange, the change was accompanied by a large and rather sudden increase in number of sherds per unit volume of refuse in the upper levels of the Western Mound. This increase might be interpreted as an increase in population, or an increase in production for export to other districts. Still other explanations might be invoked to account for the quantitative change, but these suffice to indicate the necessity for judicious evaluation of so-called objective analysis of ceramic data.

"Four Dimensional Stratigraphy" in Pueblo Structures

No infallible rules can be said to govern the order of deposition or the composition of trash deposits within the walls of large pueblos. How-

ever, the customs of the present-day Pueblo Indians can be instructive for an understanding of domestic practices in prehistoric pueblos. Contemporary observations of pueblo building practices made by Brew and Roberts merit quotation here for their relevance to the stratigraphy in the Western Mound.

Zuni Pueblo (Roberts 1932: 42)

The construction of new apartments on top of abandoned, filled-in rooms was a frequent practice among the Pueblo peoples in prehistoric times and also is quite prevalent at the present. A large portion of the central section of Zuni, that part of the village which seems to be perched on a hill, is built over vacated, debris-filled houses. As a matter of fact, both there and in some of the Hopi towns, the process which leads to such a condition is going on to-day in much the same fashion as it probably did in the past. Rooms are abandoned, the roofs are permitted to fall in, considerable sand is blown into the inclosure, and refuse is deposited there. As a result of erosive factors, portions of the walls collapse, and in a comparatively short time the chamber is practically filled with accumulated material. Then some one decides to build a new house on the site. The remains of the ruined structure are leveled, and above them rises another dwelling. During the summer of 1930 a number of such operations were under way. In two instances the replaced structures had been vacated, fallen into decay, and become more than half filled with debris in a period of three years. The remaining bits of their walls were razed to the surface of the accumulation, and then the new construction started. In the completed rooms the floors were several feet above those of the old house.

Hopi Pueblos (Brew 1937: 133)

. . . The situation [of unremitting structural changes] is well illustrated by the following observation made in 1936 at Shipaulovi, a modern Hopi town on Second Mesa, eleven miles west of Awatovi. On the south side of the plaza a new building is being constructed. Of but a single story, it is at plaza level, with a two-story house abutting it on the west and a three-story house on the east. The two-story house is reputed to be thirty or forty years old, and the three-story one, 'about one hundred.' One of the rooms on the third story of the latter is ruined. It has lost a wall and the roof timbers are hanging down into the room, all this a good ten or twelve feet above the men building the new house. Now add the probability that some of the interior rooms at the present ground level in the old house are disused and even filled up, and a stratigraphic problem appears which might almost be called four-dimensional.

The information in these recent accounts is pertinent for the interpretation of the ceramic profiles in the Western Mound. Given three rooms in a single masonry structure: the first may have continued in residential use for a century; the second, with roof dismantled and open to the weather and domestic traffic, may have filled half way to roof level with rubbish, artifacts, and blow sand; the third, filled to the top with refuse, may have been sealed over by a new mud floor, thus immobilizing its contents permanently.

In the Western Mound, this "four-dimensional" stratigraphic process resulted in unequal or differential rates of deposition of refuse in the central rooms. Contemporary strata differ in metric depth by as much as a meter. The recognition of these vertical discrepancies is based, not on identity of pottery types, but on the restoration of vessels from sherds found in different rooms. These identifications are conclusive rather than probable. For that reason, the levels containing sherds of restored vessels have been singled out as discrete physical units for temporal control of stratigraphy in adjacent rooms.

Time Levels

Time level is the term used here to designate those trash levels which, although of different absolute depths in different rooms, are shown to be contemporaneous by the presence in them of sherds belonging to the same individual vessels. The term has been selected to avoid confusion with other terms in the literature which possess established meanings for chronology and stratigraphy. We intend this term to designate physical aggregates of refuse and artifacts within the confines of a single ruin or site. Contemporaneous time levels in different rooms are, in this sense, not determined by the occurrence of sherds of the same pottery type, but by sherds that can be cemented together into a single pottery vessel.

In Figure 10 the ceramic time levels are depicted by letters which represent 38 individual jars, bowls, or ladles restored wholly or in part from sherds found in different rooms, at equal or unequal depths. For example, the letter A designates a vessel restored from sherds found in Room 305, Level *j* and Room 296, Level *j*. The letter B designates a vessel restored from sherds found in the same rooms and levels as A, but with the addition of sherds from Level *k* in Room 296. From these occurrences, we can infer that these two rooms had been filled with trash at the same rate for an interval represented by a meter or so of accumulated deposition. We cannot, of course, assume that both filled at the same rate all the way from bedrock to the surface.

In contrast to levels having equal time value and metric depth are others that show unequal

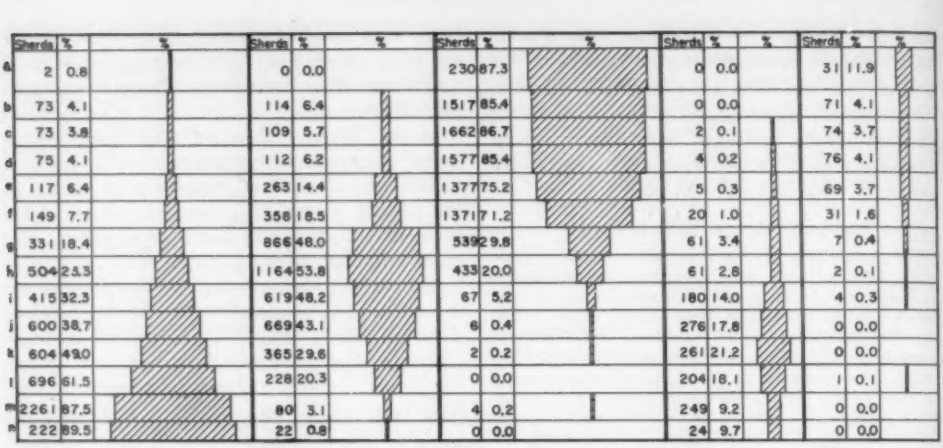

Fig. 11. Time-span chart, a composite of 13 ceramic profiles, showing stratigraphic increase or decrease in quantity of five color classes of pottery.

rates and depths of deposition. The most extreme case occurs in Room 301, Level *l 1* and Room 325, Level *i*. Sherds belonging to three restorable vessels were found in these levels, with a vertical displacement of 1.20 m. in the two rooms.

The reasons for these inter-room occurrences are not always obvious. It is possible, for example, that trash was taken from one room and dumped into another to provide artificial fill for a new floor. This might well have been the case in Room 301, where Level *l 1* is a shallow layer between two floors.

However, the significant fact to be emphasized here is that, regardless of causes, these identities in time levels have special chronological importance for the study of types and varieties, in that they establish the contemporaneity of all the pottery thus associated. Referring to the example already given: Level *l 1* in Room 301 contained seven black-on-white sherds and 20 black-on-orange sherds; Level *i* in Room 325 contained 83 black-on-white sherds, 178 black-on-orange sherds, and 17 polychrome sherds. For any further study of types and varieties, the two lots of sherds must be rated as contemporaneous, even though a difference of more than a meter exists in absolute level.

The ceramic time levels established by restoration of individual vessels have a further usefulness in that they serve as guides and controls for planning the study of pottery in large masses. In the present case, instead of starting with random and "objective" sorting of a measureless tonnage of potsherds, the analysis begins with groups of sherds from time levels known to be contemporaneous by association with restored vessels. When these associations have been ranked in terms of relative chronology, other sherds and vessels from hunderds of rooms and levels at Awatovi and at other sites can be referred to the same time clock.

Relative Time Spans of the Ceramic Color Classes

Color class is the term used here to designate the kinds of painted pottery that were locally made at Awatovi. Evidence of local manufacture is not based merely on quantity or on absence or rarity in neighboring districts, but on the technological analyses made by Anna O. Shepard. Her investigations show that local clays from the talus slopes of Antelope Mesa were the source for making pottery of the five color classes here identified (Shepard 1953: 181).

Time span is the term used to mean the interval during which each of the color classes of pottery was locally made and used. The time span may be absolute or relative, but here it refers to the duration of each color class in relation to the others, as shown in Figure 11. In al-

most all instances the time span is shorter than the stratigraphic interval, owing to the presence of maverick sherds in levels above or below the stratigraphic limits of manufacture and use of each color class of pottery.

Maverick is the term used to designate a sherd that is stratigraphically displaced. The displacement can occur in a variety of ways, by the action of human or natural agencies. Most frequently, they occur above the level of their time span, but they may occur in lower levels, also. At Awatovi, maverick sherds occur above their proper levels throughout the entire site, including areas of surface debris around the Spanish churches. It seems evident that human activity here is the principal cause for their occurrence above the terminal levels of manufacture and use. Maverick sherds can be carried downward by burrowing animals, by settlement of refuse after decay of organic materials, or by erosion.

In the Western Mound it is probable that a few maverick sherds were displaced downward accidentally during excavation. As can be seen in Figure 11, there are 12 black-on-yellow sherds from levels *j*, *k*, and *m*. The total number of black-on-yellow sherds in the upper levels is almost 9000, and it is reasonable to suppose that a dozen of these had dropped down to be collected later with sherds from deeper levels.

Estimates of the time span for each color class are summarized in Table 4 in terms of excavation levels, from level *n* at bedrock upward to level *a* at the surface. Inasmuch as the levels were arbitrarily divided at intervals of 50 cm., the upper and lower limits of the time span have a vertical amplitude of 50 cm. The reason is that any sherd collected from a single level might have come from either the top or bottom of the level.

Evaluation of the foregoing estimates of chronology, involves the resolution of apparent contradictions that appear when Figure 11 is compared with Figure 9. In Figure 11, the graphs exhibit regularity of form for each color class, rather than hour-glass contours or other distortions. In Figure 9, the individual levels in the various profiles show very great differences in the number of sherds. It was found, however, that with a few exceptions the percentage of each color class remained nearly constant for a single level, regardless of the variation in number from room to room at that level. Both charts are presented here to enable the reader to verify or challenge our interpretation.

TABLE 4. ESTIMATED TIME SPAN OF THE CERAMIC COLOR CLASSES (Fig. 11)

Black-on-white
- Interval of manufacture: Levels *n* through *g*.
- No longer made but possibly still used: Levels *e* and *f*.
- Maverick sherds: Levels *d* through *a*.

Black-on-orange
- Interval of manufacture: Levels *l* through *e*.
- No longer made but possibly still used: Levels *d*, *c*, *b*.
- Maverick sherds: Levels *n* and *m*.
- (Some, and perhaps all, of the black-on-orange mavericks may be sherds of orange-paste polychrome on which the second painted color does not appear.)

Black-on-yellow
- Interval of manufacture and use: Level *h* to surface.
- Maverick sherds: Levels *m*, *k*, *j*, *i*.

Orange-paste polychrome
- Interval of manufacture: Levels *n* through *i*.
- No longer made but still used: Levels *h* and *g*.
- Maverick sherds: Levels *f*, *e*, *d*, *c*.

Yellow-paste polychrome
- Interval of manufacture and use: Level *f* to surface.
- Maverick sherds: Levels *l*, *i*, *h*, *g*.

Estimates of Calendar Dates

The most conspicuous ceramic change in the Western Mound is the transition from white-paste and orange-paste wares to yellow-paste wares — a transition that occurs in the horizontal zone of levels *g* and *h*. In metric depth, this transition is half way between the top of the mound and bedrock. The zone of change coincides with the top of the massive double-stone walls that rest on bedrock. Above this zone, in the levels of the yellow-paste pottery, the walls of the rooms are usually single-stone in width, and less substantial than the lower walls.

In Figure 11, the replacement of white-paste and orange-paste pottery by yellow-paste pottery is not indicated by a definite horizontal line. Although the median line of the transition zone is consistently about the same height in all the rooms (3.5 m. above bedrock) the ceramic transition is actually represented by a layer of refuse more or less a meter thick.

We do not venture here to assign exact calendar dates to time levels or time spans of the ceramic color classes. However, we can say that none of our data conflicts with a date of about A.D. 1300 for the rather sudden and abundant appearance of yellow-paste pottery of the distinctive type called Jeddito Black-on-yellow. In terms of metric depth (Fig. 11), we can only say that the "1300 year line" is somewhere between 3 and 4 m. above bedrock.

At the lower end of the time scale, our evidence indicates that the first appearance of black-on-orange pottery cannot be later than A.D. 1200–1225. The "zone" of stratigraphic occurrence of black-on-orange (Fig. 11) is as great as that of black-on-yellow in thickness. Our presumption is that at least a century must be granted for its time span to accomodate the quantity of refuse and pottery accumulated when the population of the village was probably smaller than in black-on-yellow times.

For the upper or terminal age of the central rooms in the Western Mound, we have some four-dimensional stratigraphic data represented by two rectangular kivas located immediately west of the central rooms. Both of these kivas were excavated in 1936, and the mural paintings in them were recorded and later published by Smith (1952). The nearest of these kivas, designated Room 229, is about two meters west of Room 293, and the other kiva, Room 218, is adjacent to it, with a common wall between (Fig. 7).

Although the floors of these kivas are well below the level of the yellow-paste wares in the central rooms, the ceramic content of both conforms to the time span of the black-on-yellow graph (Fig. 11). Furthermore, both kivas were already filled with refuse when Sikyatki polychrome made its first appearance at the surface of the Western Mound. The style of the mural paintings in these kivas antedates that of the murals in other kivas at Awatovi.

The walls of Kiva 218 were coated with approximately 100 layers of mud plaster. Whether these layers were added more frequently than once each year cannot be ascertained, but their presence supports other evidence that a century is the minimum interval for the time span of Jeddito-Black-on-yellow before the first appearance of Sikyatki polychrome.

Etiology and Prognosis of Methods

This chronological study of ceramic color classes has entailed consideration of a variety of stratigraphic problems and analytical methods. Not the least of these has been the necessity for us to revise or to discard some of our own cherished notions for the interpretation of ceramic data. After beginning at bedrock, quite literally in the dark, we have surfaced at the top of the Western Mound with the results presented here.

Extended comment on the present analysis would at this time be more tedious than instructive. We are confident, however, that the application of the results to the study of ceramic material from the entire site will provide a useful measure of reliability for historical and cultural interpretations at Awatovi and other sites in the region. For the present, with some 50,000 painted sherds and vessels from Awatovi's Western Mound at hand in systematic order for study, we may appropriately conclude with a paraphrase from the canons of curbstone philosophy — the methods of studying pottery get better all the time, but the pottery stays about the same.

Brew, J. O.

1937 The First Two Seasons at Awatovi. *American Antiquity*, Vol. 3, No. 2, pp. 122–37. Menasha.

1949 The Excavation of Franciscan Awatovi. In "Franciscan Awatovi," by R. G. Montgomery, Watson Smith, and J. O. Brew, pp. 45–108. *Papers of the Peabody Museum, Harvard University*, Vol. 36. Cambridge.

Hack, J. T.

1942a The Changing Physical Environment of the Hopi Indians of Arizona, *Papers of the Peabody Museum, Harvard University*, Vol. 35, No. 1. Cambridge.

1942b Prehistoric Coal Mining in the Jeddito Valley, Arizona. *Papers of the Peabody Museum, Harvard University*, Vol. 35, No. 2. Cambridge.

Newell, H. P. and A. D. Krieger

1949 The George C. Davis Site, Cherokee County, Texas. *Memoirs of the Society for American Archaeology*, No. 5. Menasha.

Roberts, F. H. H., Jr.

1932 The Village of the Great Kivas on the Zuni Reservation, New Mexico. *Bureau of American Ethnology, Bulletin* 111. Washington.

Shepard, A. O.

1953 Notes on Color and Paste Composition. In "Archaeological Studies in the Petrified Forest National Monument," by Fred Wendorf, pp. 177–93. *Museum of Northern Arizona, Bulletin* 27. Flagstaff.

Smith, Watson

1952 Kiva Mural Decorations at Awatovi and Kawaika-a. *Papers of the Peabody Museum, Harvard University*, Vol. 37. Cambridge.

Woodbury, R. B.

1954 Prehistoric Stone Implements of Northeastern Arizona. *Papers of the Peabody Museum, Harvard University*, Vol. 34. Cambridge.

Peabody Museum West of the Pecos
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A NEW METHOD FOR THE SERIATION OF ARCHAEOLOGICAL COLLECTIONS*

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ABSTRACT

This graphical technique utilizes only three types of artifacts from the collection to the seriated. The relationship between the three selected types is plotted on three-pole graph paper. The points on the graph are clustered along a line representing change through time; hence the archaeological materials are arranged in their correct temporal sequence. Data from Paragonah, Utah, and Pindi, New Mexico, two Southwestern sites for which the time sequence is known, are used for empirical tests of the seriational technique. In both cases there is close agreement between the results of the seriation and the time sequence revealed by field evidence.

SERIATION, or the arrangement of archaeological materials in their chronological order by overlapping of similar traits in different finds, has a long history dating back to the "Sequence Dates" of Petrie (1904). In recent years, increased attention has been given to problems of seriation; two notable advances include the graphical technique developed by Ford (Ford and Willey 1949); and the statistical method proposed by Brainerd (1951) and Robinson (1951). Despite certain shortcomings, both of these methods work and both of them provide more sensitive measures of chronological difference than anything we have had heretofore. Some criticisims of the methods have been raised (Lehmer 1951; Bennyhoff 1951) and it is apparent that seriation techniques are neither a substitute for good field techniques nor for an adequate typology (Dixon 1956). Still, I am convinced from my own application of both of these methods to the field data from excavations, that the following statements are valid:

1. Both the Ford and the Brainerd-Robinson methods yield results that are consistent with the field data. In many cases the methods can be checked against stratigraphy, building superposition, and other field observations (Belous 1953; Collier 1955). If the results are not consistent with the field observations, other methods of age determination must be applied (Dixon 1956).

2. Seriation methods provide a more detailed picture of temporal change than stratigraphy and field observations alone. Application of these methods can give a more objective determination of the number of cultural periods present, can indicate interruptions in the temporal sequence, and can sometimes indicate the presence of mixed or disturbed collections in the sequence. Application of seriation techniques is not mere data-juggling, but an extremely useful adjunct to ordinary methods of analysis.

DESCRIPTION OF THE METHOD

In beginning a seriation, the first step is selection of the trait to be seriated. This trait must have the following characteristics: (1) abundance; (2) measurable diversity (more than one type); (3) long time span in terms of the sample seriated (the feature should occur throughout the time span studied). If pottery is present this is likely to be the best feature for seriation, although this is not always true. In southern California it is seldom possible to seriate pottery collections on a statistical basis because there is not enough diversity of types.

Assuming that pottery is used for the seriation, the next step is to reduce the number of pottery types to three for purposes of the analysis. The reduction to three types may be done in several ways:

1. Selecting the three most abundant types will usually work. In this case all other types are omitted from the seriation, although they may sometimes be used as a check on the results as described below.

2. In cases where a large part of the pottery sample consists of a common type (such as a plainware), occurring in about the same proportion throughout the time span of the sample, the common type may be skipped and the seriation done with the next three most common types.

3. *Closely related* types may be lumped together to reduce the categories to three. This is useful in cases where the sample is small and the types numerous, but lumping of types can lead to erroneous results and should be

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avoided. In practice, it takes such a short time to do the seriation that it is often feasible to plot all the possible ways in which the collection can be reduced to three types. This provides an internal check for consistent results and rapidly eliminates those combinations which cannot yield a seriation (for example, types which do not overlap in time). This point is discussed further in the analysis of the Pindi collection.

After selecting the three categories, calculate the percentage of each. Assume that the three categories total 100%; this is not true of the archaeological sample but is true for what might be called the seriational sample. In other words, for purposes of the seriation it is assumed that there are only three types present, and the relationships between these three types are used to determine the sequence. With the percentage table in hand, the figures may be plotted on triangular coordinate paper, yielding a three-pole graph. As an example, see lot 23 on Figure 1. The point on the graph where the three lines intersect represents the proportions: A–23%; B–5%; C–72%. Lot 23 was plotted as follows: on the line a-A the line at 23 was located. Along this line (23) was found the junction with the line numbered five as counted along the line b-B. This is automatically at the point 72 units along the line c-C; hence this point represents the relationship between the three percentages.

When all the lots are entered on the graph, the resulting points will usually be seen to cluster along an axis. A line is drawn through the scattered points so that there are as many points on one side of the line as the other. This line provides the seriation, and the points should be arranged along the line in their proper time sequence. If all of the three pottery types are changing through time in their relative proportions, the result should be expressed graphically as a curve rather than a straight line. However, a mathematical way of plotting such a curve is not yet available. In the present state of knowledge there is no way of knowing the direction or degree of curvature that fits the situation. For this reason it is easiest to draw a straight line through the clustered points in such a way that there is an approximately equal number of points on each side of the line and all of the points are as close to the line as possible. The individual points on the graph are then connected to the line by perpendiculars to establish their order. Since this works empirically, its relative crudity in the mathematical sense may be disregarded for the present.

There is one situation in which a straight line will actually result: This is when one of the three types plotted remains a constant throughout the time period involved. Such a plotting is in effect comparing only two changing lenses. The example for Paragonah (Fig. 1) comes close to a straight line since the percentage of one of the types changes only slightly throughout the time span involved.

Ordinarily the seriation line is not difficult to plot; the points will lie in a fairly narrow band allowing only one seriation line to be drawn. It is possible for the points to be widely scattered, however. This will occur if the site is badly disturbed or if the feature chosen for seriation does not change in a regular pattern. In such a case, no seriation line may be drawn, for several are possible and there is no way of determining the correct one. In such a case, this seriation method cannot be used and other means must be sought for chronological placement. Note that the occurrence of a seriation line on the graph is in itself a check on the method. If such a line may be drawn it indicates that there is a shift in one direction. If the unidirectional shift can be attributed to change through time, there is some reason to believe that the graph is correctly sequencing the artifact lots.

An important consideration enters here. The graph, in itself, does not tell which end of the line is the early end. For this essential information, the archaeologist must rely on field observations and other data outside of the seriation technique. This does not invalidate the method, however, for in any modern excavation the archaeologist should be able to determine from stratigraphy and other means which of his lots is at the early end of the scale.

The basic assumptions underlying the three-pole method are the same as those for the Ford and Brainerd-Robinson techniques. The major difference between the three-pole method and the others is that the former is a substitute technique utilizing only three items for seriation, rather than the full range of types as in the other methods. In other words, we place our collection in sequence by observing three of the overlapping lenses of pottery use, rather than all of them. According to the check of this method, it apparently yields results that are often as accurate as those methods using the

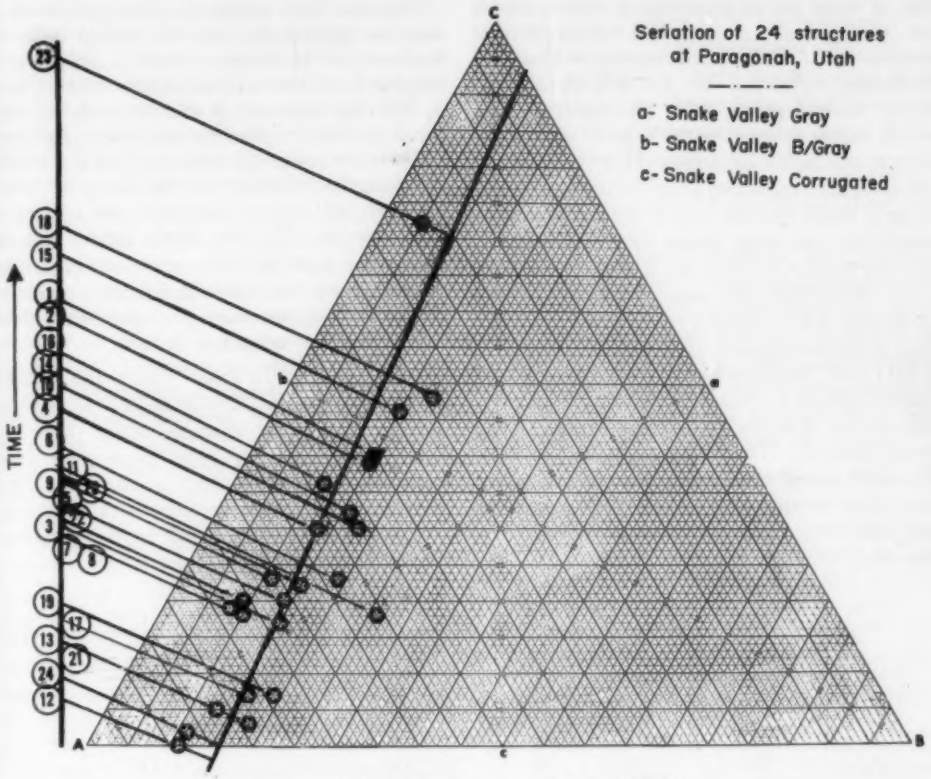

FIG. 1. Seriation of 24 structures at Paragonah, Utah.

full range of types. The reason for this is that most collections have a small number of components as the bulk of the collection, other items being numerically, and hence statistically, an insignificant portion of the total.

The limitations of the three-pole method are the same as those of other statistical seriation techniques: the sample must be adequate in size; the typology must be a true reflection of cultural changes; and all of the types utilized must occur throughout the time span in varying portions. The three-pole method has one additional limitation, namely that a selection of the total data must be made. In practice this is not a serious problem because the method is to some degree self-correcting. That is to say, an unusable selection of data yields no answer at all because no pattern can be seen in the graph. Occurrence of the clear-cut pattern is presumptive evidence of order in the collection and is an empirical validation of the selection process used.

The principal advantage of the three-pole method is that it can be done very rapidly and that it does not require extensive laboratory time. Neither is it necessary to have computing equipment, although it is useful to have an adding machine available. Once the percentages of the pottery types have been determined, the results may be entered on the graph in only a few minutes. Other statistical methods require many hours of data analysis before the seriation can be interpreted. As one example, seriation of 30 lots of material by the Brainerd-Robinson method (using an ordering board for visual arrangement of data) requires about 40 hours of working time. The same seriation can be done in 20 minutes by the three-pole method, and the results are just as accurate. Even where high speed computers are available the complexities of inter-relationships between a large num-

ber of types are so great that a very complex analysis process is indicated. Experimental attempts at U. C. L. A. to program the Brainerd-Robinson technique for the S.W.A.C. computer have suggested that the analysis time could be cut down to as little as 45 minutes or so for the 30 lot collection. However, few archaeologists have access to such a computer, and even if these facilities are available, a trained mathematician must design the data handling, and the work must be done in a laboratory context. Herein lies the major advantage of the three-pole system; since it can be done in a short time without computer equipment, it is usable as a field tool. Seriation by the three-pole method can be done as a continuing part of the excavating process, if artifact types are counted as the work proceeds. The value of this is obvious. The field superintendent can discover very precise time relationships during the excavation and can direct his future work as the information suggests.

The ease with which the three-pole method may be applied also permits several different analyses on the same collection, providing a number of internal checks on the results. That is, different segments of the data can be compared for their consistency with other segments.

There are two major ways to check this graphical seriation. Neither will tell errors in detail, but both will immediately rule out an impossible seriation. The two checks consist of comparing the seriation with other seriation lines from the same site, and with field data on stratigraphy and superposition. In more detail, these checks may be defined as follows:

1. Graphical. In cases where the artifact sample permits the calculation of two or more seriation lines (for example when there are four or more pottery types present in some abundance) there is a check on the consistency of the results. If two seriations on the same sample are widely at variance in their ordering, there is obvious reason to question the results.

Table 1. Paragonah Sherd Counts.

Structure Number	Total Number of Sherds	A. Snake Valley Gray		B. Snake Valley Black-on-gray		C. Snake Valley Corrugated	
		No.	%	No.	%	No.	%
1	1400	634	45	205	15	561	40
2	650	299	46	98	15	253	39
3	76	53	68	10	15	13	17
4	2165	1232	57	288	13	645	30
5	668	438	66	93	14	137	20
6	175	101	58	33	19	41	23
7	1510	1095	73	120	8	295	19
8	1542	1112	72	148	10	282	18
9	439	290	66	47	11	102	23
10	437	226	52	80	18	131	30
11	70	39	56	18	26	13	18
12	2503	2237	89	264	11	2	0
13	1106	908	82	148	13	50	5
14	2125	1106	52	342	16	677	32
15	309	122	39	47	15	140	46
16	890	473	53	97	11	320	36
17	454	350	77	71	16	33	7
18	906	312	34	160	18	434	48
19	330	244	74	64	19	22	7
20	2008	1268	63	292	15	448	22
21	524	412	79	94	18	18	3
22	1705	1213	71	242	14	250	15
23	1058	241	23	56	5	761	72
24	125	109	87	14	11	2	2
Total	23,175						

2. Stratigraphic. Seriations can be frequently checked against the stratigraphic information from a site. The seriation line must be consistent with the depth distribution of artifacts, and also with known cases of superposition (such as one house being intrusive into another). If the seriation line is in accord with the field observations, there is no reason to question its ordering.

The question may be raised, why go to this method if the field techniques can solve the seriation? The best answer is that the field recording seldom shows the precise relationship of *all* the material in the site; seriation does. We often know that *A* is later than *B*, and *G* is later than *F*, but our field records may not tell us anything in particular about *D*, *C* and *E*, nor the relationship between the two pairs which we can seriate in the field. Seriation techniques place all of these lots in respect to one another, thus making a more complete and detailed analysis possible.

In order to determine the accuracy and sensitivity of the three-pole graphic technique, it was applied to collections from two sites in the Southwest: Paragonah, Utah, and Pindi, New Mexico. These sites were chosen because detailed knowledge of the seriation was available from field data and it was possible to examine the graphical seriation in terms of the known answers.

A sample of 24 structures (pit houses and surface granaries) from the site of Paragonah, Utah, was seriated; pottery percentages are given in Table 1 and the seriation is shown in Figure 1. Paragonah, a site of the Sevier Fremont culture in the southwestern part of Utah, is described by Judd (1916, 1919) and by Meighan and others (1956). The site dates from about A.D. 900 to 1150. This particular site is admittedly an ideal one for graphical seriation, because the change through time is gradual but steady and because nearly all of the pottery in the site is confined to the three most common types.

As checks of the graph, there are 15 paired relationships, involving 19 of the 24 structures that can be inferred from field observations (Table 2). Every single one of these relationships is indicated correctly in the graphical seriation. Even allowing for the fact that the site provides ideal seriational materials, this is a remarkable sensitivity for the seriation technique. The site cannot span more than a couple of centuries, and if the structures are evenly distributed in time the seriation must be discriminating time differences as small as ten years. Even greater discrimination is evidenced if, as seems certainly likely, the structures were not distributed evenly in time. The field data suggest near contemporaneity for some of the paired relationships, and there is reason to suspect that the seriation has correctly sorted structures separated in time of abandonment by only a couple of years.

From stratigraphic evidence (the increase of corrugated pottery in the upper levels), it is known that Structure 12 is at the early end of the time scale. This gives the direction of change. As mentioned previously, there is nothing in the graph itself to discriminate the early from the late end of the seriation line. The values of the seriation for this site include:

1. All lots are arranged in time. Although field records yield 15 sets of relationships, it is not possible to seriate more than three lots from field data alone. That is, there is no link between one set of relationships and another except statistical comparison of the artifacts.

TABLE 2. KNOWN CHRONOLOGICAL RELATIONSHIPS OF PARAGONAH STRUCTURES.

Paired Relationship	*Structure*	*is later than Structure*	*Evidence*
1.	6	7	Superposition
2.	10	7	Superposition
3.	10	13	Superposition
4.	15	13	Superposition
5.	4	17	Superposition
6.	16	14	Superposition
7.	16	19	Superposition
8.	14	19	Superposition
9.	23	20	Superposition
10.	22	24	Superposition
11.	9	8	Shape of ventilator of 9 avoids cutting into 8
12.	9	5	Debris from burning of 5 in ventilator of 9
13.	9 and 8 should be close together in time (see above)		
14.	9 and 5 should be close together in time (see above)		
15.	1 and 2 should be close together in time (adjacent structures on top of small mound on same level)		

These relationships involve 19 of the 24 structures at the site, but no more than three of the structures can be seriated stratigraphically; there is no linkage between pairs and triplets of buildings.

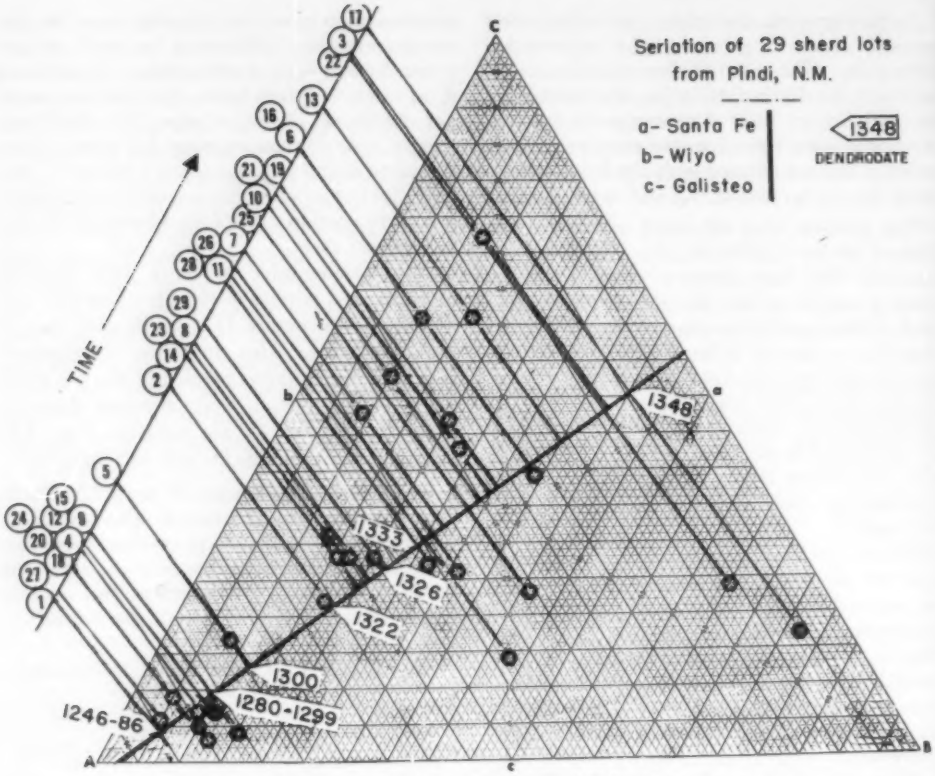

Fig. 2. Seriation of 29 sherd lots from Pindi, New Mexico.

2. The contemporaneity of two kinds of structures is verified. The seriated lots include both pit houses and surface structures; these were formerly thought to represent two cultural periods, with the pit houses occurring earliest and the surface structures replacing them. Pottery contents suggested that the two kinds of buildings were in fact contemporaneous (Meighan and others 1956: 14). This conclusion was reached without use of a seriation technique, but it is virtually proven beyond question in the seriation. Figure 1 includes the pottery from five surface structures (1, 2, 3, 6, 11). Since these occur in the middle of the seriation line, with pit houses both preceding and following them, the contemporaneity of the two kinds of buildings is clearly demonstrated.

Although the Paragonah check showed that the graph method would arrange a series of sherd lots in their correct time order, the sensitivity of the technique was still not certain. Presumably, the Paragonah samples are rather close to one another in time, but a more precise dating check seemed desirable. Accordingly, a sample of 29 sherd lots from the site of Pindi (Stubbs and Stallings 1953) was seriated. A few of these lots could be dated from dendrodates on associated wood fragments. The relationship between several additional lots could be inferred from stratigraphic information. Pindi is a Pueblo III site in New Mexico with most of its occupation in the 13th and 14th centuries. As shown in Figure 2 the 29 lots were arranged quite closely according to their correct time sequence. Further, the sensitivity of the method is again astonishingly great, since lots separated by as short an interval as four years according to dendrodates are correctly arranged.

Since Pindi, unlike Paragonah, had five pottery types occurring in some abundance it was necessary to select three types for analysis. As an experiment, the seriation was done with eight different combinations of types. The one given

in Figure 2 is the ordering for the three most abundant types. Two of the eight orderings yielded no seriation line. These had the smallest samples, including many as small as 25 sherds. A partial ordering of the other six seriations is given in Table 4. The Pindi report provides a large number of stratigraphic checks on the seriation. These were not thoroughly examined but a sample of a dozen stratigraphic checks proved to be completely in accord with the seriation line. A more important check for this seriation comes from the large number of dendrodates available, seven of which could be related to sherd lots with reasonable confidence. The best ordering (Fig. 2) arranged all the dated lots correctly.

TABLE 3. PINDI SHERD COUNTS.

Sherd Lot	Sample	Description	Total Number of Sherds	Santa Fe Black-on-white		Wiyo Black-on-white		Galisteo Black-on-white		Dendrodates
				No.	%	No.	%	No.	%	
1	Kiva B	Kiva B	739	665	90	67	9	7	1	1246-1286
2	Kiva B	Rooms 113–117 Fill of lower rooms	149	90	61	26	17	33	22	1322
3	Kiva B	Rooms 113–117 Fill of upper rooms	50	8	16	6	12	36	72	
4	Plaza	Pits below plaza	935	786	84	84	9	65	7	
5	Plaza	1st plaza fill	178	134	75	15	8	29	17	1300
6	Plaza	Pens 8, 12 Upper fill	132	39	30	13	10	80	60	
7	Plaza	2nd plaza fill	227	97	43	21	9	109	48	
8	Plaza	3rd plaza fill	77	42	55	13	17	22	28	
9	Room Block II-A-2	Refuse C	463	379	81	70	15	14	3	1280-1299
10	Room Block II-A-2	Fill of overlying rooms	118	44	37	12	10	62	53	
11	Room Block II-A-2	Refuse above	63	27	43	27	43	9	14	
12	Room Block II-A-1	Borrow pit, Kiva C, etc.	283	232	82	31	11	20	7	
13	Room Block II-A-1	Room 169, lower room	52	12	23	8	16	32	61	
14	Room Block II-A-1	Rooms between Plaza and Kiva B	653	368	56	107	16	178	28	
15	Room Block II-C	Refuse A	433	351	81	48	11	34	8	
16	Room Block II-C	Rooms S and W of Kiva B	358	96	27	122	34	140	39	
17	Room Block II-C	500 Series Room Block	354	23	7	271	77	60	16	1348
18	Room 6	Clay pit under Room 6	160	141	86	8	5	11	7	
19	Room 6	Room and rubbish	46	15	33	9	20	22	47	
20	Room Block II-B	Refuse below Room II–B rooms	210	177	85	24	12	9	3	
21	Room Block II-B	Rooms, fill	732	248	34	170	23	314	43	
22	Room Block II-B	Rooms 74, 206 3rd Bldg. period	65	7	11	42	65	16	24	
23	Room Block II-B	3rd Bldg. Period, general	721	366	56	97	13	258	31	
24	Rooms 182–305 series	Lower rooms, fill	226	191	85	23	10	12	5	
25	Rooms 182–305 series	Upper room, 182 fill	94	25	36	28	41	51	23	
26	Rooms 182–305 series	Upper rooms, 176–305 fill	136	59	43	42	31	35	26	
27	Miscellaneous	Kiva D fill	139	124	89	7	5	8	6	
28	Miscellaneous	700 Series Rooms	41	19	46	11	27	11	27	1333
29	Miscellaneous	400 Series Rooms	123	64	52	24	20	35	28	1326
		Total	7957							

Table 4. Seriations of Dated Sherd Lots from Pindi.

Ordering According to Dendrodates	Orderings According to Sherd Seriation					
	Santa Fe Wiyo Galisteo (Fig. 2)	Wiyo Galisteo Pose	Santa Fe Wiyo Pose	Pindi Galisteo Pose	Wiyo Pindi Santa Fe	Santa Fe Wiyo All others
17	17	*	17	28	28	28
28	28	28	28	17	17	17
29	29	29	29	29	29	29
2	2	5	2	5	2	2
5	5	2	5	2	*	5
9	9	9	9	*	9	9
1	1	1	1	*	5	1

* Missing numbers due to absence of one type in the sample; hence not seriated in this combination.

It will be seen from Table 4 that not all the seriations agreed in detail, although they all yielded a closely similar ordering. None of the orderings made an error greater than 26 years according to the dendrodates, and only two cases reverse lots this far apart in time. From the information available, it would be possible to calculate in detail the statistical error in the Pindi ordering. However, this would be largely meaningless for two reasons:

1. The correlation between dendrodates and sherd lots is not entirely certain and cannot be expected to be precise. A dendrodate provides a one-year span, while the accumulation of potsherds might take greater or less time. It is remarkable that the dates are ordered as well as they are in view of the many problems in correlating dendrodates with sherd lots.

2. A statistical error for this particular site would not necessarily have any application to other sites, since the precision of the seriation depends on the rapidity of culture change. This point is discussed below. For these reasons, it seems best to leave the discussion with the mere observational statement that the Pindi orderings correlate with dendrodates *in all cases* with a plus-or-minus accuracy of 25 years and *in most cases* with a plus-or-minus accuracy of ten years or less. This is about the degree of sensitivity suspected from the ordering at Paragonah.

In comparing the eight complete seriations at Pindi, there is a fairly large number of minor disagreements in ordering; that is, samples often vary by one or two positions on the seriation lines. The disagreements appear to be largely due to using too small a sample of sherds, although in some cases they may represent closely contemporaneous samples that vary in position within the limits of error described above.

Although it is gratifying to find that the two sites discussed can be seriated to separate sherd lots (and their associated site features) which lie only a few years apart it is obvious that such sensitivity is not to be expected in all cases. The sensitivity of the method is directly correlated with the rapidity of cultural change. Since Pindi is a site of the Pueblo III period, during which very rapid stylistic changes in pottery were introduced, it yields a detailed and precise seriation. In sites where the cultural change was less rapid only longer periods of time could be discriminated. Simpler cultures (paleolithic in the Old World, or something like Cochise in the New World), with only slight change over long periods, are not very good subjects for statistical analysis, since the chronological ordering can often be more readily obtained from stratigraphy or even geological or climatological change. Seriation methods come into their own in complex, rapidly changing cultures, where in some cases at least, it appears that seriation can be more informative than stratigraphic and other field observations.

Although the examples given here are all based on ceramics, it should be noted that other applications of this method are possible. For example, we could seriate a large number of sites by using the relative proportions of any three kinds of artifacts. In southern California the relative percentage of metates, projectile points, and core tools, would arrange a number of sites in their correct chronological order. The relative time position of the different grave lots in a cemetery could also be easily discoverable from this kind of seriation.

The examples given here also permit some useful observations about the size of sample necessary for a seriational method to yield reliable results. Some writers have felt that at least 100 items (sherds or whatever) should be present in each sample; others have suggested greater or lesser sample sizes but in point of fact all of these figures have been entirely im-

pressionistic. It is interesting, therefore, to examine the present seriations in terms of the minimal sample size yielding correct results. For the Paragonah seriation, there is stratigraphic information on 19 of the 24 structures involved. The samples are all relatively large, ranging from 125 to 2125 sherds. However, four of the samples consist of 175 sherds or less, and it can be said with some assurance that a sample of 125 sherds is sufficient, assuming the sample to be from unmixed deposits. In the case of the Pindi seriation, the samples are somewhat smaller (this may account for the greater scattering of the points on the Pindi graph). Of the seven lots correlated with dendrodates, sample size ranges from 41 to 739 sherds and averages a little under 300 sherds. Other orderings based on different combinations of types yielded correct answers with samples of as few as 25 sherds.

There is little doubt that accuracy increases with the size of the sherd sample, but this evidence shows that samples of 100 sherds or even less are usable with some degree of confidence. In general, it can be said that absolute size of sample is not too important provided that the collection comes from unmixed refuse. There are two important implications for field methodology in this statement. The first is to pay very close attention to signs of aboriginal digging or other disturbance; the second is that sherd lots should not be mixed with one another but should be very carefully separated by room units or even smaller subdivisions. The practice of lumping together sherds from six or seven different rooms should be avoided even though the samples are small. These reminders are simply a reinforcement of standard field methodology; seriations, like all other analytical results, are directly dependent upon the care with which the excavation is done.

Acknowledgments. I am indebted to Winifred Frankel, who originally suggested the possibility of this kind of analysis and who assisted in graphing some of the preliminary orderings. I am also grateful for the assistance of R. J. Hill and W. S. Robinson who examined the statistical and mathematical basis for the work. Keith Johnson assisted in tabulating the Paragonah data. Finally my thanks go to Stanley Stubbs, co-author of the Pindi report, for his checking of my results and for valuable additional information about the Pindi collections. After completing this paper, my work was examined by Marcia Ascher who drew up some mathematical formulations for the work and suggested additional ways in which the graphs can be drawn. Her ideas, which represent both improvements and better understanding of the system, are set forth in the following paper.

BELOUS, R. E.

1953 The Central California Chronological Sequence Re-examined. *American Antiquity*, Vol. 18, No. 4, pp. 341–53. Salt Lake City.

BENNYHOFF, J. A.

1951 The Viru Valley Sequence: A Critical Review. *American Antiquity*, Vol. 17, No. 3, pp. 231–49. Salt Lake City.

BRAINERD, G. W.

1951 The Place of Chronological Ordering in Archaeological Analysis. *American Antiquity*, Vol. 16, No. 4, pp. 301–13. Salt Lake City.

COLLIER, DONALD

1955 Cultural Chronology and Change as Reflected in the Ceramics of the Viru Valley, Peru. *Fieldiana: Anthropology*, Vol. 43. Chicago Natural History Museum, Chicago.

DIXON, K. A.

1956 Archaeological Objectives and Artifact Sorting Techniques: A Re-examination of the Snaketown Sequence. *Western Anthropology*, No. 3. Berkeley (?).

FORD, J. A., AND G. R. WILLEY

1949 Surface Survey of the Virú Valley, Peru. *Anthropological Papers of The American Museum of Natural History*, Vol. 43, Pt. 1. New York.

JUDD, N. M.

1916 Archeological Reconnaissance in Western Utah. *Smithsonian Miscellaneous Collections*, Vol. 66, No. 17. Washington.

1919 Archeological Investigations at Paragonah, Utah. *Smithsonian Miscellaneous Collections*, Vol. 70, No. 3. Washington.

LEHMER, D. J.

1951. Robinson's Coefficient of Agreement — A Critique. *American Antiquity*, Vol. 17, No. 2, p. 151. Salt Lake City.

MEIGHAN, C. W. AND OTHERS

1956 Archeological Investigations in Iron County, Utah. *University of Utah, Anthropological Papers*, No. 25. Salt Lake City.

PETRIE, W. M. F.

1904 *Methods and Aims in Archaeology*. Macmillan, London.

ROBINSON, W. S.

1951 A Method for Chronologically Ordering Archaeological Deposits. *American Antiquity*, Vol. 16, No. 4, pp. 293–301. Salt Lake City.

STUBBS, S. A., AND W. S. STALLINGS, JR.

1953 The Excavation of Pindi Pueblo, New Mexico. *Monographs of the School of American Research and the Laboratory of Anthropology*, No. 18. Santa Fe.

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A MATHEMATICAL RATIONALE FOR GRAPHICAL SERIATION

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ABSTRACT

An algebraic explanation is offered for the graphical method of seriation proposed by Meighan. A suggested simplification of the graphing technique makes it possible to plot the seriation on ordinary graph paper rather than on three-pole graph paper.

IN THE PRECEDING PAPER Meighan proposes a method for the field seriation of archaeological materials. This paper is an attempt to explain its algebraic foundations. In addition, a slight modification of the proposed method is suggested. The technique consists of selecting three artifact types, and using their sum in each lot as 100%, finding the percentages of each. The three percentages from each lot are used to plot one point on a three-pole graph. The points are then fitted by eye with a "best" line and a perpendicular is drawn from each point to the line. The order of the points of intersections along the line is considered to be the ordering of the lots in time. As each point is placed on the three-pole graph, it can be noted that any two of its three coordinates completely define the point. Since we take their sum to be 100%, we have a, b, and c=100-a-b, which give only two linearly independent quantities. For this reason, choosing two of the types and graphing their percentages on ordinary graph paper will give the same result. However, percentages should still be computed on the basis of at least three types.

When attempting to fit a line to the points, we suggest the use of a least-squares "best" fit. Although the use of least-squares curve fitting may seem needless since the data are not precise, there are three reasons it should be used: (1) the method of least-squares is designed as a data smoothing or correcting technique for observed data; (2) it is preferable to use a technique which, given the same data, leads to the same results regardless of the user; and (3) it seems wasteful to further compound errors that may exist by using a subjective "best" line. A seeming drawback to using this method of curve fitting is that it assumes that one set of observed values is being fitted to a set of more accurate values. In this case both sets of percentages being used are observed data. A solution to this difficulty is to fit two "best" lines, each minimizing the deviations along one coordinate. Although this might seem like undue effort, it may serve as an internal check indicating whether the graphical technique is vaild for the data being used.

The method discussed in the remainder of this paper is that described by Meighan, but modified in the two respects noted. Our primary interest is to explain why the graphed points sometimes tend to be a line, and why this line reflects the temporal sequence of the points.

Let us assume that we are dealing with samples from lots whose dates are known. If we graph the percentage of a particular type from each lot against the date of the lot, we would expect the graph to show a gradual rise until a peak is reached and then a gradual decline, provided that the dates of the lots cover the range of existence of the type. This type of curve is the basis of other seriation methods (Ford and Willey 1949; Robinson 1951). However, if only a short span of time is covered by the lots, we might observe only a rise or only a decline.

Consider a hypothetical case in which the percentages of Types A and B from lots with known dates (Table 1) form lines when graphed against time. If we ignore the dates and apply the graphical technique, we arrive at the graph in Figure 1 *a*. It is found that both "best" lines are identical and that they are not approximating the points which have been plotted. Rather, all the points lie on the line and are in their proper temporal order. If instead of using the graphical technique, we approach the data algebraically, we can see why we arrive at that line and the point ordering on the line. Each of the sets of percentages is a linear function of time. The percentage of A has Equation 1 and that of B, Equation 2 (Table 2). If we treat time as a parameter, we can eliminate it by solving Equations 1 and 2

TABLE 1. DATA FOR HYPOTHETICAL CASE.

Percentage of A	*Percentage of B*	*Date*
10	30	900
20	32	920
30	34	940
40	36	960

together and arrive at Equation 3 (Table 2). This is also a linear function of time and is precisely the line we found graphically (Fig. 1 *a*). We can see in Equations 1 and 2 the relationship between the percentages of A and B and time. For any given value of either percentage there is only one possible value of the other and of time (t). Equation 3 must exhibit the data in their proper time sequence because of the linearity of the two original functions.

If real data actually gave rise to exact linear functions of time, the results would always be a straight line and the lots in their correct order. This is obviously not the case. However, if we have a sufficiently short span of time, and if the time interval does not include the peak, we may be dealing with data which closely approximate linear functions. The "best" line is fitted to the graphed results in order to approximate linearity. The less the data are like linear functions, the less likely it is that the approximated line will reflect their true time dependence. The graphical technique diverges from the algebraic reasoning as this happens. However, when the divergence is not too great, the algebraic reasoning is a good explanation of the graphical results. It can be shown that both the line and

TABLE 2. EQUATIONS.

1.	$\%A = 0.5t - 440$
2.	$\%B = 0.1t - 60$
3.	$\%A = 5\,(\%B) - 140$
4.	$\%G = 0.440t - 559$
5.	$\%W = 0.228t - 282$
6.	$\%W = 0.518\%G + 7.57$

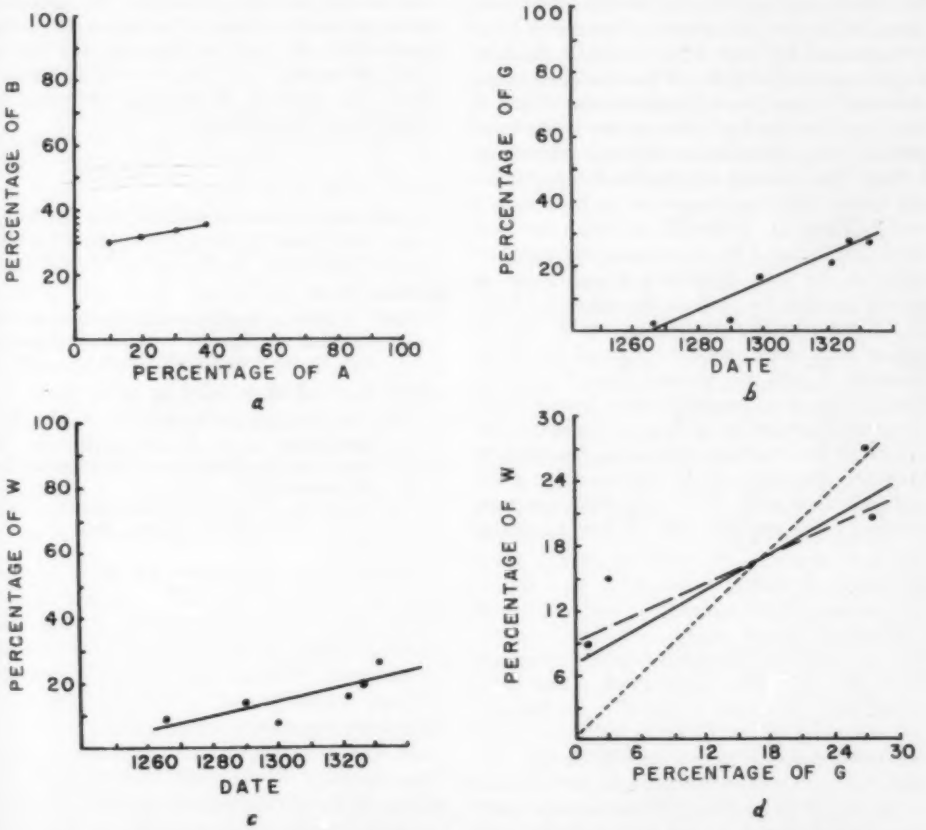

FIG. 1. Graphs illustrating the algebraic explanation of the method of seriation described by Meighan.

Table 3.

Sample Sherd Percentages and Dates from Pindi.*

Percentage of Galisteo Black-on-white (G)	*Percentage of Wiyo Black-on-white (W)*	*Dendrodate*
1	9	1266**
22	17	1322
17	8	1300
3	15	1290**
27	27	1333
28	20	1326

* Taken from Table 3 in Meighan's paper.

** The mean of the actual range of dates is used here to simplify this illustration of the method.

the ordering resulting from the graphical technique can be closely, although not exactly, predicted by its algebraic counterpart when field data for which dates are available are used. We have selected six lots which have been dated by dendrochronology at the site of Pindi (Stubbs and Stallings 1953) to use in illustrating this point (Table 3). When the percentages of these lots are plotted against time (Fig. 1 *b*, *c*), it can be seen that they are not linear functions of time. But when we fit these points with a "best" line, we can see that they approximate the linear functions expressed in Equations 4 and 5 (Table 2). It should be noted that both these lines (Fig. 1 *b*, *c*) preserve the temporal order of the lots. Equations 4 and 5 can be solved together to produce Equation 6 (Table 2). If we plot the percentages of W and G against each other, we have a graph on which Equation 6 can be shown (Fig. 1 *d*, solid line). If we drop perpendiculars from each of the graphed points to the line of Equation 6, as is done in the graphical technique described by Meighan, the order of the intersections of the perpendiculars with the line is the correct sequence of the graphed lots. When we ignore the known dates and fit the points in Figure 1 *d* with "best" lines, we obtain the two dashed lines shown on the graph. These lines are fairly close to the algebraically predicted line (Fig. 1 *d*, solid line) and both preserve the correct temporal sequence.

Combining this result with that of the hypothetical case also demonstrates the usefulness of fitting two "best" lines to the points. In the first example, both fitted lines were identical since the hypothetical data were true linear functions. In the second example, although the lines give the same temporal result for the lots, they are not identical. We might expect that, if the data were less nearly linear, the graphical technique would give spurious results, and that it would show up in the "best" lines being quite different and probably leading to contradictory orderings. An internal check of this type seems necessary, because the graphical technique outlined here cannot always be relied upon. This algebraic explanation may not include all possible cases, but it is hoped that it places the method of seriation described by Meighan on a firmer basis.

Ford, J. A. and G. R. Willey

1949 Surface Survey of the Virú, Peru. *Anthropological Papers of the American Museum of Natural History*, Vol. 43, Pt. 1. New York.

Robinson, W. S.

1951 A Method for Chronologically Ordering Archaeological Deposits. *American Antiquity*, Vol. 16, No. 4 pp. 293–301. Salt Lake City.

Stubbs, S. A. and W. S. Stallings, Jr.

1953 The Excavation of Pindi Pueblo, New Mexico. *Monographs of the School of American Research and the Laboratory of Anthropology*, No. 18. Santa Fe.

Los Angeles, Calif.
May, 1959

ARCHAEOLOGICAL EVIDENCE FOR THE USE OF ATLATL WEIGHTS IN THE NORTHWEST

B. Robert Butler and Douglas Osborne

Abstract

Wilson Duff's tentative identification of several lower Fraser River artifacts as atlatl weights led the authors to examine 104 whole and fragmentary probable weights from the Northwest. They classify them on the basis of lashing grooves, notches, holes, or scars into three main types, each of which has variants. The weights are found in the lower Columbia and lower Fraser river valleys with a concentration in the Dalles-Deschutes region and range in time from the late Middle to the early Late periods of the Dalles Reservoir sequence, about 500 B.C. to A.D. 1400. Metallurgical analysis of a hollow copper bead found with two weights indicates that it is prehistoric and suggests connections to the east. The weights are often found paired in burials. Although ethnographic comparisons are disappointing, archaeological comparisons reveal possible relationships between the Northwest and California, the Great Basin and the Southwest, especially during Basketmaker II, and the eastern Woodlands. The possibility that the Northwest atlatl weights may be derived from eastern forms reinforces the previously presented idea that the Northwest participated in certain continent-wide developments.

WILSON DUFF (1956) has recently described ten objects from the lower Fraser River which he tentatively identifies as atlatl weights. He bases this identification on the resemblance of the objects to certain Hopewell atlatl weights and to the raised decorative motif on a wooden atlatl dredged from the mouth of the Skagit River (Taylor and Caldwell 1954). Duff (1956: 75) describes the basic shape:

> . . . a high dome with two sides somewhat flattened so that the base forms an oval or rounded rectangle. Drilled through the flat sides are conical holes which perforate the artifact completely or (in four cases) enter a rounded depression hollowed out of the base.

Four of them are sculptured with human or animal features. Two are decorated with incised lines, and the rest are plain. The objects range from 3.8 to 11.2 cm. in length (average 5.8 cm.), 2.3 to 4.5 cm. in width (average 2.9 cm.), and 3.8 to 6.0 cm. in height (average 4.8 cm.). The sculptured specimens tend to be higher, narrower, and longer than the plain and incised ones. They are all made of soapstone. The hollowed base is a feature of eastern boatstones and might indicate either a relationship, or similar function, or both.

For the past several years we have been collecting data on a type of artifact which local collectors call a "medicine man's measure" (Seaman 1946: 41–2, 130–1). A series of these artifacts was recovered by Butler from the Congdon site, a cremation-burial site in the Dalles Reservoir on the lower Columbia River (see Butler 1957a for site locations in the Dalles Reservoir). Osborne suggested at the time that these objects were not unlike atlatl weights from the Southwest (as quoted in *Screenings*, 1956, Vol. 5, No. 9). Since 1955, artifacts of a form similar to that described by Duff have been found in association with "medicine man's measures" and with a type of artifact resembling the California boatstone (Heizer and Elsasser 1953: 26–30, Figs. 4 *a-g*, 5 *a-f*). We have studied a total of 104 whole and fragmentary specimens of these several kinds of artifacts. They can be readily sorted into three basic types according to the number and location of lashing grooves, notches, holes, or scars.

Type I

Type I is almost identical in general form to the type described by Duff (Fig. 1 *a-f*). The base is flat and there is a single, transverse perforation at or near the midsection. There are two main variants. Type Ia is a more or less flat-sided hemisphere, usually plain, but occasionally with an end-to-end groove on top (Fig. 1 *a-e*). Type Ib is in the form of a zoomorphic sculpture (Fig. 1 *f*).

We have records on 18 complete and fragmentary specimens of Type Ia: 13 complete and three fragmentary weights of galena, a badly eroded specimen of limestone, and one in the Hall collection of a light brownish-red material similar to pipestone but coarser and less dense. The latter weight has an end-to-end groove on top and the hole is enlarged so that it appears to be biconical (Fig. 1 *e*). We have handled seven of the 13 galena weights; Strong has supplied information on the remaining six. The over-all dimensions of the seven we have studied directly are given in Table 1; the weight range and average are based on all 13 specimens. One galena weight has a deeply incised end-to-end groove on top. Strong (1958, Fig. 6)

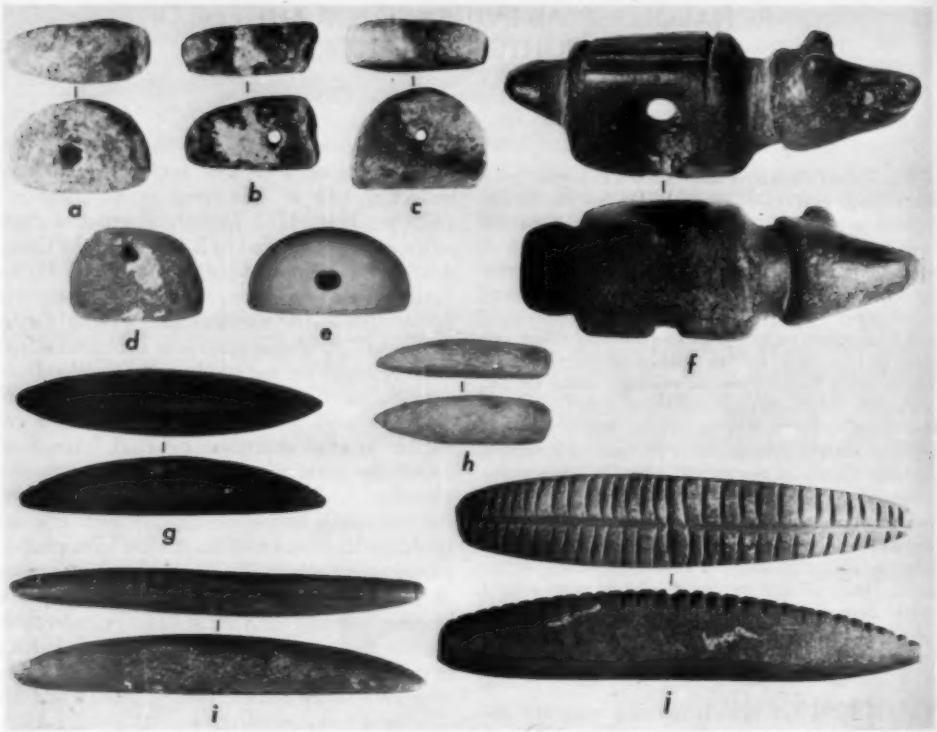

Fig. 1. Types I and II atlatl weights. *a–e*, Type Ia; *f*, Type Ib; *g–j*, Type II. *a–d*, galena; *a–c*, *i*, *j*, McLeod collection, from Big Leap site, near Celilo Falls, Oregon; *d*, collected by Emory Strong from a burial site near Wakemap Mound; *e*, Hall collection; *f*, Cowles collection; *g*, *h*, Stewart collection, Washington State Museum, from the Dalles-Deschutes region. *g*, *h*, photos by Campus Studios, University of Washington; photos of others through the courtesy of Emory Strong. No scale; *f*, 10.6 cm. long, 3.5 cm. wide, approximately the same in height, about 199 grams.

illustrates a stone weight of this type which weighed only 43 grams. Our Type Ia series is generally smaller than Duff's in over-all dimensions. A galena weight similar in size and shape to ours is described by Seaman (1946: 82–3) who considered it an odd material and shape. It was found in a site just downstream from The Dalles Dam. A weight somewhat similar to our Type Ia is illustrated by Kidder and Guernsey (1919: 180, Fig. 88 *b*, Pls. 82 *b*, 83 *b*). It was found below an atlatl and in contact with the convex side in a Basketmaker II cist. This weight is of white limestone with natural bands of red and has a transverse perforation near the end from which a projection rises. Although the lashings themselves are missing, their scars are evident.

The probable source of the galena is of interest. L. W. Staples, Professor of Geology, University of Oregon, informs us that there are no known important sources close to The Dalles The nearest sources occur to the west of the Dalles area in both Oregon and Washington along the western slopes of the Cascade ranges. Strong (1958: 4) reports that lead weights have been found along the banks of Pend Oreille and Coeur d'Alene rivers in Idaho. With this possible exception, galena weights seem to be limited in distribution to the Dalles-Deschutes region as defined by Strong, Schenck, and Steward (1930). The stone specimens are also concentrated in the Dalles–Deschutes region, although Strong has recently received word of a stone weight recovered from a cave in southeastern Oregon.

Type Ib is relatively rare. Only one complete and two fragmentary pieces in private collections are known. Strong (1958) states that the

TABLE 1. MEASUREMENTS OF THE ATLATL WEIGHTS.

Type of Atlatl Weight	Length in Centimeters		Width in Centimeters		Height in Centimeters		Weight in Grams	
	Range	Average	Range	Average	Range	Average	Range	Average
Ia	3.6–4.5	4.1	1.7–3.4	2.2	1.8–3.3	2.9	71–168	105
II	7.9–13.5	10.6	1.5–2.4	2.1	1.9–2.4	2.2	32–65	55
IIIa	4.5–9.5	7.2	2.3–4.8	3.6	2.3–4.3	3.5	53–298	174

complete one, which is made of a hard, black, probably igneous stone, was found in association with three Type IIIa atlatl weights (Fig. 1 *f*).

TYPE II

The Type II weight (Fig. 1 *g-j*) is very similar to the California boatstones described by Heizer and Elsasser (1953: 26–30, Figs. 4 *a-g*, 5 *a-f*) and also reminiscent of some of the eastern Woodland boatstones. It is usually elongate with a more or less flat, but never hollowed, base that tapers slightly upward at the ends. The ends are also tapered and there is usually a single, transverse notch across the top of each end. Occasionally one end is broken off at the notch. One specimen (Fig. 1 *i*) has a series of transverse notches running from one end to the other with an end-to-end groove dissecting them. Most of these weights are hemispherical in cross section. Measurements of six whole

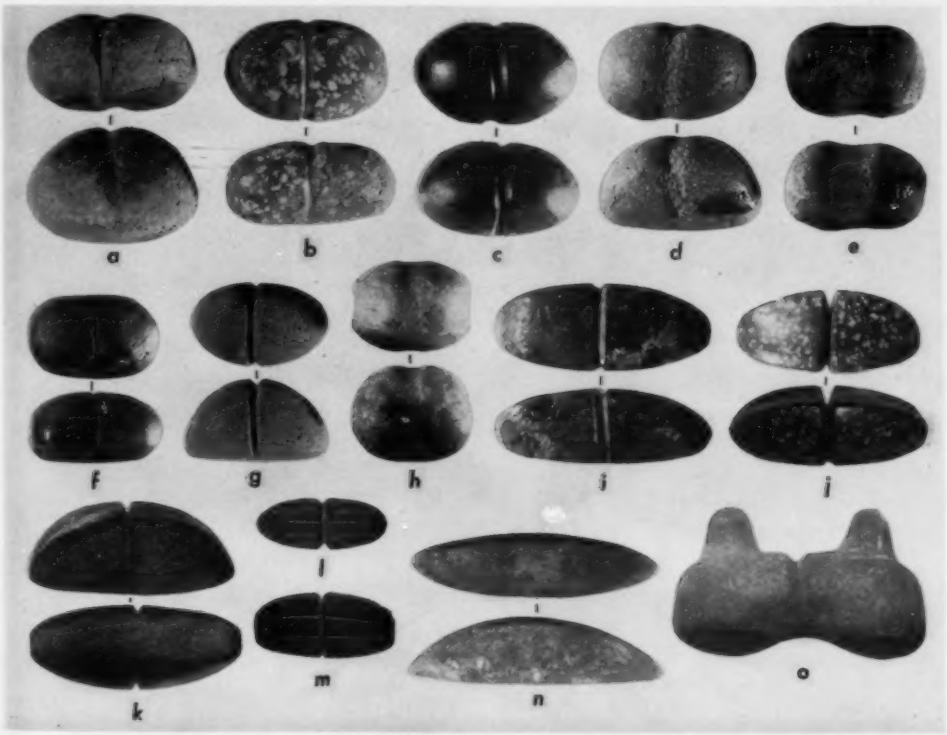

FIG. 2. Type III atlatl weights. *a–m*, Type IIIa; *n*, Type IIIc; *o*, Type IIId. *a*, *b*, *g*, *n*, McLeod collection, from Big Leap site, near Celilo Falls, Oregon; *c–f*, *h*, *i*, Congdon site, Dalles Dam Reservoir; *j*, *k*, Norton collection, from Fountain Bar in the Columbia River, approximately 30 miles upstream from The Dalles, Oregon; *l*, *m*, Wakemap Mound; *o*, probably lower Columbia valley (photo courtesy of Emory Strong). No scale; *n*, 9 cm. long, 2.4 cm. wide, 2.3 cm. thick, 34 grams; *o*, 6.5 cm. long, 3.1 cm. high.

specimens are given in Table 1. Three of these are of hard stone, usually felsite; the other three are softer materials. The weights of this type which we have studied come from the Dalles-Deschutes region and the northern Great Basin in eastern Oregon. However, a wider distribution is indicated in a series of letters to Emory Strong published in a recent issue of *Screenings* (Vol. 7, No. 6). Specimens collected by amateurs are reported from the Priest Rapids area of the Columbia River, central Washington; from the mouths of the Palouse and Tucannon rivers, southeastern Washington; along the Yakima River, near Mabton, Washington; along the Columbia River, near Alderdale, Roosevelt, Fountain Bar and Cliffs, Washington; and from Vancouver Lake, near Vancouver, Washington. These recently reported specimens indicate an almost continuous distribution of Type II weights from the lower, middle, and upper Columbia regions, as well as southeastern Oregon.

Type III

The type III weight is the most common form in the lower Columbia valley (Figs. 2, 3). We have observed or have information on 66 specimens of this type, well over half of our total sample. Our analysis is based on 41 specimens which we have handled plus data on others furnished by Strong and Duff. Nine specimens in the Peabody Museum of Natural History, Yale University, are included in this sample. Type III is the most variable in form; there are four subtypes. Types IIIa (Figs. 2 *a-m*, 3 *a-f*), IIIb (Fig. 3 *g*), IIId (Fig. 2 *o*) have a three-quarter groove across the midsection which runs up the sides and over the top of the weight. Type IIIc (Fig. 2 *n*) has lashing scars running up the sides and over the top at the midsection. It is quite similar to the Basketmaker atlatl weights described and illustrated by Guernsey (1931: 72, Pl. 50).

The typical, better made, Type IIIa specimens are characterized by a slightly concave to slightly convex base, or wide longitudinal basal groove, and excurvate sides. The ends are blunt or flat. The top may be flat or concave between the edges as it curves downwards to the ends. Guernsey and Kidder (1921: 81) use the term "loaf shape" in describing a somewhat similar

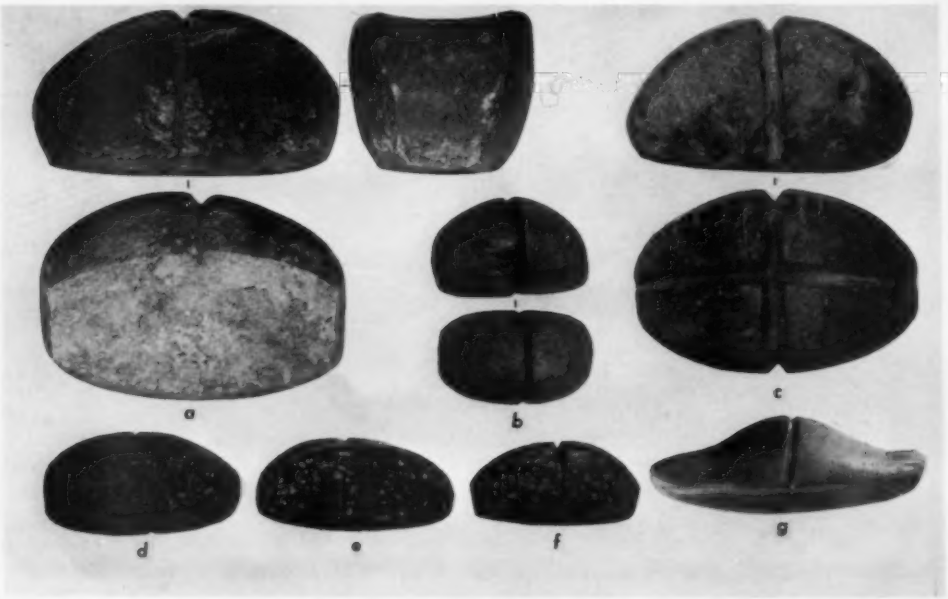

Fig. 3. Type III atlatl weights. *a–f*, Type IIIa; *g*, Type IIIb. *a*, *c*, Wakemap Mound; *b*, *f*, Stewart collection, Washington State Museum, from the Dalles-Deschutes region; *d*, *e*, collected by Emory Strong from a burial site (Atlatl Valley) near Wakemap Mound; *g*, Holm collection, from the Musselshell River, near Roundup, Montana. *b*, *d–f*, photos by Campus Studios, University of Washington. No scale; *g*, 8.3 cm. long, 3 cm. wide, 2.6 cm. high, 79 grams.

series of weights (although lacking the diagnostic three-quarter groove) which had been lashed to the undersides of atlatls from Basketmaker II caves in northeastern Arizona. The top, sides and even the bottom may have one or more narrow and deep longitudinal grooves which cut across the three-quarter groove (Fig. 2 *l*, *m*) or otherwise form decorative patterns. One specimen has a single longitudinal groove on top and a series of short, transverse, incised lines along one of the upper edges (Fig. 3 *c*). Another specimen has a wide, shallow, longitudinal groove over the top (Fig. 2 *h*). The overall measurements of 38 weights are given in Table 1. These specimens are usually made of hard porphyries and felsites.

Duff has sent us information on a Type IIIa weight of white crystalline limestone from the north shore of Sooke Inlet, southern Vancouver Island. Kidder and Guernsey (1919, Pl. 83 *a*, *c*) and Guernsey and Kidder (1921, Pl. 33 *d*) illustrate several Basketmaker II weights that are similar to our Type IIIa except that they lack the three-quarter groove. However, these Basketmaker weights have lashing scars over the midsection and the characteristic "loaf shape" of some of our more "poorly" made Type IIIa specimens.

Type IIIb is represented by a single specimen of tan-colored crystalline limestone collected by William Holm of Seattle from a gravel bar in the Musselshell River some 5 miles west of Roundup, Montana. This weight (Fig. 3 *g*) has a bulging, dome-like midsection and a wide, longitudinal, basal groove. The sides and top taper in toward the narrow upturned ends. Over the upper edge of each end is a series of short, whisker-like, incised lines. A narrow, three-quarter groove runs up the sides and over the top at the midsection.

Type IIIc (Fig. 2 *n*) has a flat base and top. The sides are excurvate and taper to nearly pointed ends. We have only two specimens, both from a burial site, the Big Leap site, near Celilo Falls, Oregon. The one illustrated is made of a hard felsite and has lashing scars over the midsection. The second weight is made of a soft, chalky material and is badly eroded. Type IIIc somewhat resembles Type II, but is shorter and thicker. Webb and DeJarnette (1942, Pl. 306, 2, 2) illustrate a specimen of similar proportions to our Type IIIc; Guernsey (1931, Pl. 50) shows a Basketmaker weight bound to an atlatl which is similar to the Type IIIc form. The latter is shorter and wider than the two Type IIIc specimens and has a weight which is intermediate between them.

Type IIId is represented by two specimens (Fig. 2 *o*). The one not illustrated (Peabody Museum, Yale University, No. 3156) is primarily a blocky, shapeless, Type IIIa form with the typical three-quarter groove, but with a nipple carved on one end similar to those that rise from the top of the weight in Figure 2 *o*. The Yale weight is made of a dense, heavy, gray, igneous stone. Somewhat larger than the illustrated specimen, it weighs 283 grams.

Our present knowledge of the distribution of Type III weights in the Northwest indicates that the main variant, Type IIIa, runs from the Portland-Vancouver area of the lower Columbia through the Dalles-Deschutes region on up to the Vantage area in central Washington and, with a great jump, to Vancouver Island. The center of distribution (in a quantitative sense) appears to be the Dalles-Deschutes region with possible secondary concentrations in the Portland-Vancouver area and around the mouth of the John Day River. Type IIIb has been reported no farther west than Montana. It may have a more easterly distribution. The other variants, Types IIIc and IIId, are apparently confined to the Columbia Valley. However, we anticipate further finds of Type IIIc which may considerably extend its distribution, probably into the Great Basin and the Southwest.

The geographic distribution of all three types in the lower Columbia Valley appears to be centered in the Dalles-Deschutes region with secondary concentrations at the mouth of the John Day River and in the Portland-Vancouver area. Duff (1956: 75) noted that his specimens were confined to the lower Fraser from Marpole to Yale with the main concentration upriver. The apparent concentration of weights in both the lower Columbia and the lower Fraser may simply be the result of the rather limited amount of archaeological research outside of these areas. However, we should not overlook the possibility that there may be some association between the occurrence of these artifacts and the economic activities that lead to a concentration of population near the great rapids of the two rivers.

The temporal distribution is predominantly in the late Middle and early Late periods of the Dalles Reservoir sequence (Butler 1957a). The late Middle period may have begun about 500

B.C.; the early Late period probably ended about A.D. 1400 (Butler 1957b). The weights occur in burial, cremation, and habitation sites. Their occurrence in cremations is restricted to the early Columbia valley cremation complex which may date between 1200 and 2500 years ago in the Dalles Reservoir area. No examples were recovered from the earliest component on the Washington side of the Dalles Reservoir which has a tentative date of over 6000 B.P. The latest occurrence of the weights is in Stratum 2 of the Wakemap Mound, a stratified habitation site in the Dalles Reservoir with radiocarbon dates ranging from 560 to 1090±200 years B.P. (Butler 1958; Caldwell 1956; Crane and Griffin 1958: 1103). Only Types II and IIIa were found at this site.

Although the weights have not been found in association with historic trade goods, Strong discovered a Type I galena weight and a Type IIIa stone weight with a small sliver of bone, a large conical copper tinkler, and a hollow copper bead (Fig. 4). These objects were roughly in a line in the ground and there was no evidence of separate graves or pits. The Type IIIa weight was about 17 cm. away from the bone sliver along the line of the long dimension of the decayed bone. The Type I weight was about 2 cm. beyond the Type IIIa weight. The bases of the two weights were roughly in the same plane. About 19.5 cm. beyond and still roughly in line with the long dimension of the fragment of bone, but about 30° off a level formed by the bases of the weights, was the tinkler with its long axis roughly aligned with the whole series of objects. At the end of the tinkler lay the hollow copper bead (Strong 1958, Fig. 2). The copper tinkler, which is in an advanced state of corrosion, has been partially restored. It appears to have measured slightly more than 9 cm. in length with an upper diameter of about 1 cm. and a lower one of nearly 2 cm. The copper bead has been analyzed by William C. Root, Bowdoin College, who indicates that it is made of copper which is definitely different from the historic copper found in the region. The historic trade copper has traces of silver, tin, lead, arsenic, and bismuth (Kroll 1957). The copper of the hollow bead contains a trace of silver and a (?) trace of lead. Root comments:

> The bead . . . seems to be of prehistoric origin. . . . [and] to have been made from quite pure copper. The Lake Superior copper, which is the only copper of prehistoric origin from the northern part of the United States that I have analyzed, is also pure copper except for a little silver. I wish that you would have the bead cleaned by electrolysis . . . to see how it was made. I would not be surprised to find that it was made from sheet copper bent together in some fashion. I doubt that it was cast.

Following Root's suggestion, arrangements were made through Strong for the cleaning of the bead by Alvin R. Batiste, metallurgist, Technical Laboratory Section, Bonneville Power Administration, U.S. Department of the Interior, Vancouver, Washington. Batiste describes the method used in cleaning the bead:

> Dip for 2 or 3 minutes in sulphuric acid (1:10) at room temperature. Scrub with bristle brush under running water and dry. Dip for 3 or 4 minutes in dichromate pickle (sulphuric acid 8 oz/gal., balance water to make 1 gallon). Rinse thoroughly in cold running water, then in hot water containing 1 oz/gal. soap, and dry. It may be necessary to repeat to remove corrosion products. Glassware, stoneware or stainless steel containers should be used. Suggested methods for cleaning corroded nonferrous specimens are given in Appendix II of the American Society for Testing Materials (ASTM) B 185–43T: "Total Immersion Testing of Non-ferrous Metals."

Batiste molded a section of the cleaned artifact in transoptic mounting powder, ground, and polished it. The polished section was then etched with a mixture of ammonium hydroxide and hydrogen peroxide. Batiste states:

> On the basis of the microstructure, the artifact may have been formed from rolled or hammered copper and was heated above the recrystallization temperature of the metal during or after forming.

Details of the manufacture of the bead are shown in Figure 5. The bead was wrought, presumably from a hammered sheet of copper. The grain structure demonstrates that it was

Fig. 4. Hollow copper bead found with a copper tinkler, a Type I galena weight, and a Type IIIa stone weight. Photo courtesy of Emory Strong.

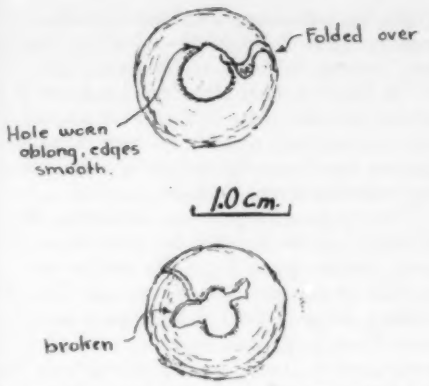

FIG 5. Detail of the hollow copper bell showing method of manufacture. Drawing by Emory Strong.

not cast. It was annealed, probably during the process of manufacture, and most likely when the copper was being hammered into a suitable sheet. As the illustrations show, the bead was formed by bringing the edges of the sheet together in a toothed pattern and then feather-edging them. This information adds to our understanding of the metallurgical knowledge of the makers of the bead, but it does not tell us anything of their cultural affiliations. Root's analysis suggests that they worked in the Great Lakes area or with copper from there. Unfortunately, so little has been done with the copper of the Northwest that we cannot determine whether the copper is of western origin or whether local artisans made the bead. We guess that the bead is an import from the East or the Midwest. A relationship of a typological nature between some of our weights and the boatstones or bar weights from the eastern part of the country has been suggested and cultural relations with the Eastern Woodlands or with related areas have been postulated previously (Osborne, Caldwell, and Crabtree 1956; Osborne 1958). The implications of both the typological study of the atlatl weights and the metallurgical analysis of the bead throw into sharper focus the need for a thorough examination of the archaeological and ethnological relationships between the cultures of the Northwest and those in the East and Midwest.

Strong observed another interesting association in a burial near the Wakemap Mound ("Atlatl Valley"). He found a pair of galena weights some 3 feet from the surface and presumably in a grave because there were tiny fragments of bone present in a probable pit (Strong 1958, Fig. 3). The area had been badly disturbed by collecting activities and no evidence of the level of origin of the pit could be discerned. The two galena weights lay opposite each other, only a few centimeters apart, and with the bases nearest one another. The drilled tops were away from a line between the two weights suggesting that the weights might have been attached to a shaft which lay between or beneath them. Charles Hall has reported a Type I stone weight associated with a bone tube and a large crescent-shaped shell object in a flexed burial.

The weights are occasionally found in paired associations. Strong has given us the information on pairs in Table 2.

TABLE 2. ASSOCIATED PAIRS OF ATLATL WEIGHTS.

1. Type III, stone (246 grams) with Type III, stone (240 grams).
2. Type I, galena (168 grams) with Type III (184 grams).
3. Type I, galena (76 grams) with Type III, stone (170 grams).
4. Type I, galena (96 grams) with Type I, galena (116 grams).
5. Type IIb, stone (199 grams); Type IIIa, stone (283 grams); Type IIIa, stone, (283 grams); Type IIIa, stone (298 grams). These four were found together but cannot be separated into pairs because no record was kept of their relative locations.

Thus, each type has apparently been found in association with every other type, and Types I and II are usually associated with Type III. The more numerous Type III weights are frequently found in pairs. Associations of lead and stone are more common than associations of lead and lead. Paired pieces of stone are generally of roughly the same weight, while paired pieces of galena vary in weight. Galena specimens found with stone weights are always the lighter of the pair. This contrast may be caused in part by the disintegration of the galena. All galena weights were surrounded by a whitish area when found. This whitish material becomes dry and powdery on drying. If this possible loss through weathering is taken into account, it may be conjectured that the Type Ia weights may have been roughly the same weight as the Type IIIa specimens with which they were usually paired. The galena weights in Pair 4 (Table 2) differ by 20 grams; this may be due in part to differential weathering of the galena. Two Type IIIa weights, one in the Washington State Mu-

seum and one in the Strong collection, show some evidence that they had been wrapped in a matting which, on decaying, left parallel stains on the stone. One pair, a galena Type Ia and a Type IIIa weight with four decorative top grooves, was found beneath a cremation pit long since looted by collectors. They had been baked in the heat-hardened soil. Below the galena item was a soft place as if an object had decayed there. The feeling is well developed among all of the men who have found the weights in situ that they were in graves.

There are but few disjointed data which aid in placing these items in a cultural and chronological context. First is the problem of the use of the atlatl in the area at the ethnographic time-level. Strong quotes the Spaulding (1953: 41) edition of Robert Stuart's narrative concerning the use of throwing boards on the lower Columbia in the first years of the 19th century. The same statement appears in the scholarly Rollins (1935: 14) edition where, in a short discussion of the taking of animals with "darts" Stuart mentions use of single barbed points for animals, "three points of light bone, spread and barbed," for birds, and the usual light harpoon for seals and sea otter. This harpoon had the head attached to the shaft by a lanyard so that the shaft acted as a drag to tire the struck animal. It was used by Aleut and by northern Northwest Coast people. This description is followed by the statement that "the boards used in throwing these darts are very judiciously fixed, in semblance of a gutter, which enables the natives to cast them with great exactness to a considerable distance." Although Osborne has known of this reference for a number of years, he had always assumed that Stuart observed a group of Aleut sea-otter hunters in action and not unnaturally confused them with the local natives. The description of Aleut and Tlingit hunting methods is exact, and there are no other references to similar techniques or objects along the Columbia. The nearest ethnographically-documented throwing sticks that we know are found among the Tlingit (for example, Niblack 1890, Pl. 27, 127). The Tlingit throwing sticks lack a weight and have obvious similarities of form to those of the Aleut.

The archaeological evidence is more extensive. Cressman (1942: 69) found atlatls without weights in the Great Basin. He also believes that he has atlatl spurs from his Five-Mile Lock site in the Dalles Reservoir. Some objects that might be crude examples of our Type II weights were found with Burial 11–222 at the Kawumkan Springs midden (Cressman 1956: 429, 457–8, Fig. 51). They were found in levels II–IV which are older than 7500 to 3500 B.P. according to radiocarbon dates. Cressman (1956: 429) suggests that these objects may be bolas, but this interpretation seems unlikely.

There is little information concerning the associations of the weights described here. The more crudely made Type IIIa weights as well as a few of the better made ones, the Type IIIc weights, some Type I galena specimens, and some Type II weights have been found in association with a wide variety of relatively large and heavy points similar to those which have been identified as dart points in the Great Basin and the Southwest. The two sites, Congdon and Big Leap, from which the bulk of the crude weights have come, are rich in artifact traits. Among these are large, thick-walled sandstone pipes (a few are illustrated in Butler 1957a), which are unlike the later, more typical or better known, Columbia Valley pipes, and ovoid two-holed gorgets not unlike Eastern Woodland gorgets. The Type IIIa and Type Ia weights recovered from the site near Wakemap Mound (Atlatl Valley) appeared to have been associated with the fragile, beautifully pressure-chipped, corner-notched type of point tentatively named Columbia Valley corner-notched (Caldwell 1956: 45–54). They are variable in size, ranging somewhat larger than the typical recent arrowpoints but are by no means as large or heavy as the points associated with the more crudely made Type IIIa weights. They are so similar to the late arrowpoints that they must be typologically related.

A number of examples of hunting scenes recorded by Mark Hedden (1956) and Sari Dienes show a hunter following a line of mountain sheep. These scenes are in Petroglyph Canyon, an area of sheer basalt walls along the Columbia River about a half a mile above Wakemap Mound. Apparently the man is often depicted in the act of casting a spear or throwing a dart with the spearthrower. The bow is less often shown here than it is farther upstream and in the Basin.

Our initial impression of these artifacts, whose function we have suggested is that of an atlatl or spearthrower weight, was that they were designed to be rather securely hafted to resist some sort of centrifugal force and that

they were not used as a percussion instrument or sinker. Their apparent utilitarian design is not what one would expect of objects which had only a ceremonial or decorative function.

There is no concrete evidence of either use or hafting, although a Type IIIc specimen does have evidence of lashing scars over its midsection. Methods of lashing were probably similar for all three types: over the ends for Type II, through the perforation for Type I, and over the midsection or central groove for Type III. The bottoms are shaped or flattened and are generally plane or slightly convex, but with a slight upcurve at the ends. This base could have been readily bedded on a shaft and the whole securely lashed so that it would have withstood the centrifugal force of a throw. Perhaps the upcurving ends facilitated the insertion of tightening wedges. The fact that the base is often the least scarred and least finished section of the artifacts would indicate that it was protected during whatever usage they may have seen.

It is possible that these objects were used as bolas or as clubs. The bolas suggestion has been discounted already as far as Type II is concerned. The bolas idea makes rather more sense in terms of Type Ia forms, but the pieces seem heavy, and in the case of the galena specimens, fragile for this use. The rounded Type IIIa weights (Fig. 2) resemble small club heads. But, clubs in this area are short, heavy, *patu*-like things. The blackjack type commonly used on the Plains is a late intrusion into the Northwest. Furthermore, the weight of a number of the specimens is often too light for a club head. The relative lack of battered and broken weights does not support the suggestion that they were striking weapons.

If these objects are atlatl weights, they raise numerous problems. Type II and possibly Type Ia may be part of a more-or-less continent-wide boatstone tradition. Types IIIa and IIIc weights are apparently related to Basketmaker II and other Southwestern and Great Basin weights. These resemblances suggest that the Dalles area participated in the major flow of cultural development in western North America. They also raise the possibility that some of the Northwest weights may have derived from eastern Woodland forms. The use of galena is especially suggestive. We expect that traits of this sort will lead us toward a clearer understanding of Northwest archaeology in terms of continent-wide problems.

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BUTLER, B. R.

1957a The Art of the Lower Columbia Valley. *Archaeology*, Vol. 10, No. 3, pp. 158–65. Cincinnati.

1957b Dalles Reservoir Prehistory: a Preliminary Analysis. *Washington Archaeologist*, Vol. 1, No. 8. Seattle.

1958 Archaeological Investigations on the Washington Shore of The Dalles Reservoir, 1955–1957. MS submitted to National Park Service in partial fulfilment of National Park Service – University of Washington contract for archaeological studies in the Reservoir.

CALDWELL, W. W.

1956 The Archaeology of Wakemap, a Stratified Site near the Dalles of the Columbia. MS, doctoral dissertation, University of Washington, Seattle.

CRANE, H. R. AND J. B. GRIFFIN

1958 University of Michigan Radiocarbon Dates II. *Science*, Vol. 127, No. 3306, pp. 1098–1105. Washington.

CRESSMAN, L. S.

1942 Archaeological Researches in the Northern Great Basin. *Carnegie Institution of Washington, Publication* 538. Washington.

1956 Klamath Prehistory. *Transactions of the American Philosophical Society*, n.s., Vol. 46, Part 4. Philadelphia.

DUFF, WILSON

1956 Prehistoric Stone Sculpture of the Fraser River and Gulf of Georgia. *Anthropology in British Columbia*, No. 5. Victoria.

GUERNSEY, S. J.

1931 Explorations in Northeastern Arizona. *Papers of the Peabody Museum, Harvard University*, Vol. 12, No. 1. Cambridge.

GUERNSEY, S. J. AND A. V. KIDDER

1921 Basket-Maker Caves of Northeastern Arizona. *Papers of the Peabody Museum, Harvard University*, Vol. 8, No. 2. Cambridge.

Hedden, Mark

1956 The Mountain Sheep of Petroglyph Island. MS, on file in the Washington State Museum, University of Washington, Seattle.

Heizer, R. F. and A. B. Elsasser

1953 Some Archaeological Sites and Cultures of the Central Sierra Nevada. *Reports of the University of California Archaeological Survey*, No. 21. Berkeley.

Kidder, A. V. and S. J. Guernsey

1919 Archeological Explorations in Northeastern Arizona. *Bureau of American Ethnology, Bulletin* 65. Washington.

Kroll, W. J.

1957 Report on the Composition of Indian Copper Beads Found at the McNary Dam, Oregon. *Bureau of American Ethnology, Bulletin* 166, pp. 227–31. Washington.

Niblack, A. P.

1890 The Coast Indians of Southern Alaska and Northern British Columbia. *U.S. National Museum Report*, 1887–88. Washington.

Osborne, Douglas

1958 Western American Prehistory — An Hypothesis. *American Antiquity*, Vol. 24, No. 1, pp. 47–52. Salt Lake City.

Osborne, Douglas, W. W. Caldwell, and R. H. Crabtree

1956 Problems of Northwest Coast–Interior Relationships as Seen from Seattle. *American Antiquity*, Vol. 22, No. 2, pp. 117–28. Salt Lake City.

Rollins, P. A. (editor)

1935 *The Discovery of the Oregon Trail: Robert Stuart's Narratives*. Charles Scribner's Sons, New York.

Seaman, N. G.

1946 *Indian Relics of the Pacific Northwest*. Binford and Morts, Portland.

Spaulding, K. A. (editor)

1953 *On the Oregon Trail: Robert Stuart's Journey and Discovery*. University of Oklahoma Press, Norman.

Strong, Emory

1958 Evidence of the Atlatl in the Pacific Northwest. *Screenings*, Vol. 7, No. 4. Oregon Archaeological Society, Portland.

Strong, W. D., W. E. Schenck, and J. H. Steward

1930 Archaeology of the Dalles-Deschutes Region. *University of California Publications in American Archaeology and Ethnology*, Vol. 29, No. 1. Berkeley.

Taylor, H. C. and W. W. Caldwell

1954 A Carved Atlatl from the Northwest Coast. *American Antiquity*, Vol. 19, No. 3, pp. 279–80. Salt Lake City.

Webb, W. S. and D. L. DeJarnette

1942 An Archeological Survey of Pickwick Basin in the Adjacent Portions of the States of Alabama, Mississippi, and Tennessee. *Bureau of American Ethnology, Bulletin* 129. Washington.

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THE INCENSARIO COMPLEX OF PALENQUE, CHIAPAS *

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ABSTRACT

The three major forms of Palenque incensarios, the great majority of which appear to be locally made, are pedestal-based vessels, ladles, and elaborately decorated, hollow, flanged cylinders. The first two forms were clearly used for burning incense, but the elaborate cylinders show no definite evidence of burning. They may have served as stands or supports for incense burners, and in any case, are certainly related to the incensario tradition in Mesoamerica. At Palenque, this tradition seems to be oriented toward the hierarchical aspects of Maya civilization. The decoration on the flanged cylinders shows close resemblances to the symbolism and the manner of portrayal in Maya monumental art. While the Palenque incensarios are fundamentally similar to those in other parts of Mesoamerica, they are quite distinctive in both shape and decoration. The main correspondences are with Late Classic incense burners in southern Tabasco and the Alta Verapaz.

AN IMPORTANT BODY of ceramic materials from Palenque, Chiapas, Mexico, relates to the burning of incense. As at other Maya sites, it is impossible to delimit these materials in a wholly satisfactory way. While certain forms seem unquestionably to have served as incense burners, the use of others remains in varying degrees of doubt. Recognizing these limitations on a strictly functional identification, we nevertheless have isolated pottery that gives direct evidence of incense burning activities (for example, by fire blackening) or that shares diagnostic characteristics with known or assumed censers elsewhere in the Maya area. These considerations allow us to speak of an "incensario tradition" or "complex," based primarily upon formal features of shape or decoration but having strong functional overtones.

The incensario complex of Palenque comprises three major forms. The first of these to be considered is a pedestal base censer, with vents in the pedestal and outflaring upper walls. The second is the ladle incense burner, often with animal head effigy handle. The last is a hollow clay cylinder with wide vertical side flanges, notable for the rich development of its modeled decoration. A limited number of additional forms, not discussed in the present paper, may also relate to this complex.

* Expanded version of a paper read at the 23rd Annual Meeting of the Society for American Archaeology at Norman, Oklahoma, in May, 1958.

Palenque incense burners must be seen against the general cultural background of the site. Situated in the westerly reaches of the Maya area, Palenque combines a high development of Classic architecture, art, and epigraphy with a distinctive sculptural style and a striking divergence from the ceramic norms of better known portions of the Maya area. As pointed out in a recent preliminary report (Rands and Rands 1957), Preclassic materials are rare at Palenque, and the ceramic sequence as at present understood dates mostly from the Middle and Late Classic. Some early material suggests relationships in the direction of the Petén, while later deposits have closer ties with the Tabasco–Coastal Campeche regions. Comparisons exist also with the pottery of the Alta Verapaz. Nevertheless, the ceramics of Palenque are set off by specific combinations of paste, shape, and decoration from the bulk of Classic Maya pottery and even from apparently contemporaneous nearby sites sampled in our reconnaissance of the region.

Incensarios at Palenque belong almost exclusively to a ceramic class characterized by quartz-tempered, red-brown paste. There are grounds for believing that this may be a local ware, made at or close to the site. Unlike other wares, the red-brown pottery is important throughout the occupation, undergoing little change in frequency. It is present in a wide range of vessel forms. Cache vessels and the abundant figurines occur almost exclusively in this ware, as well as figurine molds, which are fairly numerous at the site. It is on such grounds as these, plus the rarity of Palenque red-brown pottery at adjacent contemporaneous sites, that we incline strongly to the position that the Palenque incensarios were manufactured at the ruins, or very close to them. Clay deposits are available at the foot of the escarpment on which Palenque is located.

As already explained, three major types appear within the incensario complex at Palenque. In using the term "complex" we do not mean to imply the coexistence of these forms, as a tightly knit unit, through time or away from Palenque. Absent or extremely rare at the site are such forms as the three-pronged and "loop-nose" incense burners discussed by Borhegyi

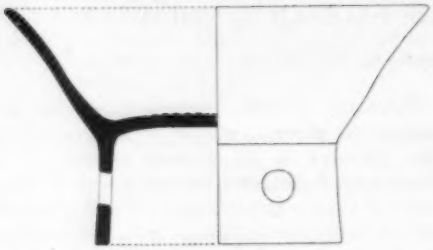

Fig. 1. Pedestal base incense burner, Palenque. Rim diameter, 35.8 cm. See Figure 3 for photograph of basketry-impressed floor.

(1950, 1951a, 1951b, 1951c) and, of course, the Postclassic Mayapán type (Thompson 1957). Such well known features of incensarios as effigy covers, symmetrical hour-glass shape, and heavily spiked decoration are likewise unknown.

Pedestal-base censers from Palenque have well-smoothed surfaces, which are usually lightly washed (Figs. 1–3). A final white coating is often applied. Fire-blackened interiors are common (Fig. 2 *a*). The floor of one large receptacle (Figs. 1, 3) bears the imprint of what has been provisionally identified as 3/3 twill basketry by Irene Emery, Research Curator, Textile Museum. Vents, which tend to be circular, regularly appear in the pedestals (Figs. 1, 2 *b*), although triangular openings are also found. Pedestal walls are usually almost vertical, expanding only slightly toward the bottom. In contrast, the upper walls are moderately to widely outflaring (Fig. 1). A flat lip, with the slight suggestion of a groove, is characteristic. In some specimens, a few small, randomly spaced spikes occur on the vessel exterior (Fig. 2 *a*), contrasting with the large, regularly arranged spikes that are characteristic of many Maya incensarios. Decoration, when present, consists of simple incision. The majority of the vessels are unornamented.

The use of the pedestal to form a two-chambered vessel constitutes a basic feature of many Mesoamerican incensarios. Shapes somewhat resembling those of Palenque occur at Uaxactún in the Tzakol phase (Smith 1955, Fig. 17 *b*, 8); San Agustín Acasaguastlán in the Motagua Valley, where they probably date from the Magdalena phase, that is, Late Classic into Plumbate times (Smith and Kidder 1943: 144, 174, Fig. 22 *c*, *e*, *g*); Piedras Negras (Butler 1935, Pl. VI, 18); and various late Postclassic (Cintla horizon) sites in coastal Tabasco and Campeche (Berlin 1956: 139, Fig. 6 *jj*). Incensarios of generally similar shape are found outside the Maya area, as at Tres Zapotes (Drucker 1943, Fig. 41). Incense burners of the Palenque type, with relatively vertical pedestal and outflaring upper walls, however, are distinctive. They lack the extensive use of spikes, thumb-impressed fillets, or other appliqué that is pronounced in the above-cited examples. Use of vents in the pedestal may occur even more frequently at Palenque than on most of the comparative material from other sites. The Palenque censers are generally more carefully finished, but the presence of a white coating is a feature which links these Palenque forms with their partial counterparts in other portions of the Maya area.

Fragmentary examples of ladle incense burners are widespread at the site of Palenque. The only bowl form definitely recognized as belonging to this class is an unusual one. Flat-based with flaring sides and everted rim, it bears nubbin tripod feet in at least one example. Handles are tubular and often have the rather distinctive feature of being open at the juncture with the bowl (Figs. 4, 5 *f*). The distal end is closed. Small circular holes, perhaps for the

Fig. 2. Fragments from pedestal base censers, Palenque.

FIG. 3. Basketry-impressed floor of pedestal base censer, Palenque. See Figure 1 for profile.

emission of smoke, occur in some of the handles (Fig. 5 *d*). Handles may be plain (Fig. 5 *f*), or modeled into the likeness of snakes (Fig. 5 *b*, *c*, *e*), crocodiles (Fig. 5 *d*), or birds (Fig. 5 *a*). Traces of blue and white paint sometimes remain. Human heads are not depicted. A single spike occasionally appears on the handle, close to the juncture with the bowl (Fig. 4). Single-spiked handles are rare on ladle incensarios from the Maya area. A similar treatment is known from Uaxactún (Smith 1955, Fig. 66 *b*, 2), and in the Alta Verapaz a variant occurs in which the spike seems to form a support at the distal end of the handle (Seler 1904, Fig. 17 *c*).

Other ladle censer handles from the Alta Verapaz bear resemblances to Palenque which are clear-cut and striking. Figure 6 shows examples from the Dieseldorff Collection, in the Museo Nacional de Arqueología y Etnología of Guatemala. Similarities to Palenque incensarios are found in effigy head crocodiles (Figs. 5 *d*, 6 *c-e*) and the heads of snakes with upturned noses (Figs. 5 *c*, 6 *b*). The eyes, horny scales, and incised triangular teeth of the crocodiles are treated in a closely comparable manner. Underscoring these stylistic correspondences is the similarity in the red-brown, quartz-tempered pottery, a feature characteristic of ceramics from both the Alta Verapaz and Palenque.

Ladle censers as a generic form have a long time span in the Maya area, occurring in the Early and Late Classic, as well as Postclassic (Wauchope 1948: 118, 126, 150; Woodbury and Trik 1953: 191). A tubular-handled variety includes effigy reptilian heads reminiscent of those of Palenque and the Alta Verapaz. This form dates from the Tohil (Plumbate) phase at Zacualpa and other highland Guatemalan sites and is also associated with Plumbate at Copán (Wauchope 1948: 151; Lothrop 1933: 97; Longyear 1952: 43). Such decisively late associations are, however, lacking at Palenque.

The most elaborated class within the incensario complex at Palenque comprises the flanged cylinders (Figs. 7–9). These ornate objects consist of a hollow tube with flanking vertical flanges. The front of the cylinder is modeled in high relief to portray a series of grotesque faces, rising one above the other. The great depth of the modeling is seen to best advantage in the profile views (Figs. 7, 8). The wide

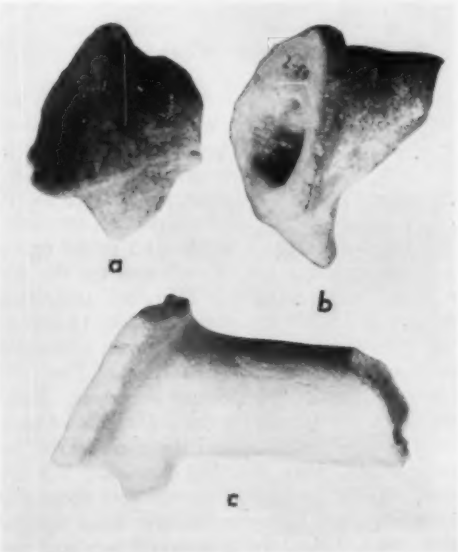

FIG. 4. Fragments of spiked ladle censer handles, Palenque.

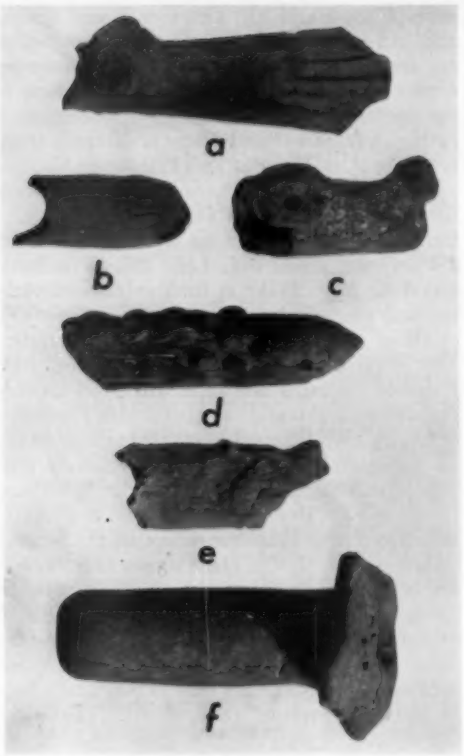

Fig. 5. Fragments of ladle censers, Palenque. Handle length of *f*, 13.5 cm.

flanges, which extend almost the complete length of the cylinder, are richly ornamented in low relief. The Palenque specimens, consistently of red-brown ware, are tall, complete examples ranging from approximately 70 to 110 cm. in height. The modeled cylinders are extraordinarily massive. Although 1.5 to 3.0 cm. is a fairly typical range of thickness for the unadorned portion of the cylinders and their flanges, this often increases to 12 to 13 cm. at the heavy brow ridges and is even greater at projecting features such as the nose. Traces of blue or blue-green paint are frequent. Some tendency is apparent for the paint to have been used as decoration around the eyes, as well as to highlight other modeled elements. We are reminded of Thompson's comments about the incensarios of Mayapán, where areas around the eyes of Chac, the long-nosed rain god, are often painted green (Thompson 1957: 606–7). Also, Wauchope (1948: 125) has discussed the association of blue paint with the burning of copal.

Elsewhere, tubular "incense burners" with side flanges are known which represent tiers of heads. Although stylistically distinct in their modeled decoration from the cylinders of Palenque, the general conception is clearly the same. A few examples serve to indicate the generic relationships to the Palenque forms. Specimens from Hatzcap Ceel, British Honduras, probably date from the Holmul V period (Thompson 1931: 257, Pl. 27). On cleaning a flanged cylinder of similar type from nearby Tzimin Kax, Thompson (1931: 312) noticed the distinct "smell of copal." Yet another specimen from British Honduras depicts a bird head in the upper tier (Gann 1934, Fig. 6), thereby offering a generalized comparison to a frequent Palenque motif (Figs. 8, 9). Outside the Maya area, in Period II at Monte Albán, the superimposed motif, decorating a cylinder with wide lateral flanges, takes the form of a human head surmounted by a monster mask (Kelemen 1943, Pl. 121 *c*). The latter has been identified as either an incensario or a burial urn.

This combination of form and decoration establishes the relationship of the ornate Palen-

Fig. 6. Fragments of effigy ladle censers, Alta Verapaz. Dieseldorff Collection.

que cylinders to ceramic objects repeatedly identified as incense burners. At Palenque, the cylinders are completely hollow. Open at the top and base, they show no division into upper and lower chambers, thus differing from a large body of Maya incensarios. As they also lack the closed top characteristic of three-pronged incense burners (Borhegyi 1951a), the question of how they functioned naturally arises. Facing a similar problem in regard to hollow flanged cylinders from Paso Caballo, near Lake Petén Itzá, Smith (1944: 41) has written:

> . . . they are obviously allied to the flanged incense burners so commonly found in many parts of Middle America. . . . But their open bases render them unfit to hold a change of incense. They might have served either as removable chimneys for burners or possibly, like pot stands, to support an incense receptacle.

According to a suggestion by Borhegyi (1959), large hollow cylinders may have been used as parts of composite three-pronged incense burners, the top portions, including the actual receptacle for the incense, being removable. Because of the apparent absence of pronged fragments at Palenque, the precise details of Borhegyi's reconstruction would not appear to be applicable. However, it would have been quite possible to rest a small vessel or disc for burning incense on the top of the Palenque decorated cylinders. In the sherd in Figure 10 this suggestion is strengthened by the interior modification

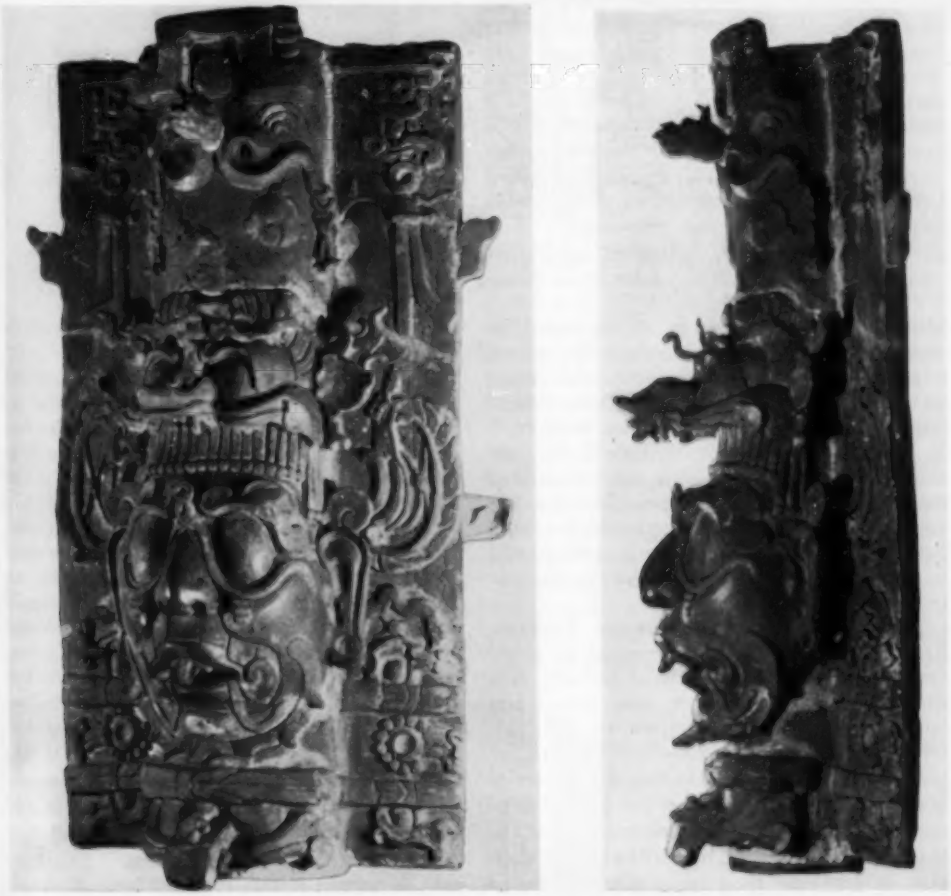

FIG. 7. Flanged cylinder, Offering 6a, Foliated Cross, Palenque. Approximate height, 105 cm.; width, 62 cm.

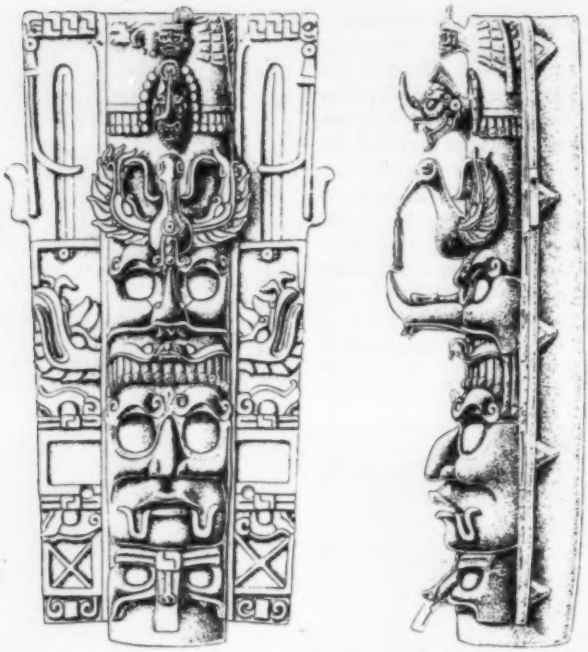

Fig. 8. Flanged cylinder. Offering 1b, Foliated Cross, Palenque. Height, 85 cm.; width, 46 cm. Drawing by Hipólito Sánchez V.

of the rim, which would be ideally suited for supporting a receptacle or cover. The use of a removable pottery disc has also been discussed by Boggs, in relation to two hollow, flanged "incensarios" of modified hour-glass shape from El Salvador (Boggs 1949: 37, Figs. 2, 3). Like the Palenque examples, these are not divided into upper and lower chambers. The disc was apparently fitted into the interior of the cylinder, being supported in one case by a flange and in the second specimen simply by the constriction of the vessel wall.

It is possible that the massive Palenque flanged cylinders could have served as chimneys, being placed over incense burning in a shallow tray or on the floor. Ceremonial fires on temple floors and altars are known from other sites (Shook 1954: 258–70; 1958), but the general absence of fire blackening on the interior of the cylinders argues against this use at Palenque. Although it remains uncertain what explanation applies to the tubular forms of Palenque, in any case their basic resemblances to established incensarios are strong. If they were not actually used for the burning of incense they still incorporate much of the incensario tradition, and so represent a related form.

At Palenque, a recurrent artistic pattern on the flanged cylinders consists of superimposed heads surmounted by a bird and additional minor figures. The second head from the bottom serves as the principal one. In the other two or three heads, the lower jaw is absent; the upper heads perhaps constitute a headdress. All faces are grotesque, and apparently represent supernatural beings. Often occurring in the principal position is a Roman-nosed head with a loop passing under the eyes and twisted over the bridge of the nose. This deity has sometimes been thought to personify the sun but is probably to be identified as the jaguar god of Number 7 (Spinden 1913: 18, 72, 74; Proskouriakoff 1950: 59, 89; Thompson 1950: 88, 134). The main head on the flanged cylinders at Palenque is occasionally shown with additional attributes of this deity, such as filed T-shaped upper incisor teeth and beard (Fig. 7) or jaguar ear. A naturalistically modeled bird often appears above the heads. Its widespread wings consist of conventionalized serpent heads in pro-

FIG. 9. Flanged cylinder, Offering 4, Foliated Cross, Palenque. Reconstructed height, 95 cm.; width, 52 cm.

file — the so-called "wing panel" that is frequently found in the stone sculptures (Spinden 1913: 61). The profile drawing of one of the cylinders (Fig. 8) reveals the presence of a composite ornament strung from the bird's beak. Typically, two additional figures rise above the masks. These are small and show considerable variation, ranging from a naturalistically seated human to serpents (Fig. 7) and varied grotesques (Figs. 8, 9).

Like the main body of the cylinder, the vertical side flanges show the repeated use of certain elements. Modeled in low relief, these appear in bilateral symmetry. Shown in the accompanying illustrations (Figs. 7–9) are plaited mat-like bands which border the top of the flanges, pendant tassels, profile Long-nosed God or serpent heads, X-shaped designs, earplug-like objects, and the wing panel. A small outward extension toward the top of each flange forms another recurrent feature. The highly standardized appearance of the cylinders as described undoubtedly results, in part, from the fact that all complete examples come from a single ceremonial deposit at the pyramid of the Foliated Cross (Sáenz 1956). Although additional elements are to be found among the thousands of sherds from flanged cylinders elsewhere at Palenque, this general pattern may be considered characteristic.

As has been pointed out, generic resemblances to the flanged cylinders of Palenque exist in a large number of specimens from Mesoamerica which have been more or less definitely identified as incensarios. Specific resemblances are, however, unusual. The Palenque specimens tend to be taller, more massive, and better fired and finished than the great body of flanged incensarios from other parts of the Maya area. Their wide uninterrupted side flanges are often longer and, in general, bear more elaborate decoration.

The most similar forms we know to these Palenque specimens are clay tubes, recovered with broken side flanges, from Zopo Cave, which lies near the Tabasco-Chiapas border about 25 miles west of Palenque (Blom and La Farge 1926–27, Vol. 1, Figs. 122–124). Tiers of grotesque heads are present with rounded eyes and pronounced superorbital ridges shown in the Palenque manner. In one case, the principal head is human rather than grotesque. The Zopo Cave cylinders are approximately 80 cm. high, a figure within the Palenque range.

"Incensarios" from the region of Teapa (Cook de Leonard 1954, Figs. 1, 1 *a*) and Tapijulapa, Tabasco, share resemblances with the Palenque flanged cylinders. The sites are some 50 to 60 miles west of Palenque. While of lower and broader proportions than the Palenque cylinders, these Tabasco specimens basically retain a flanged cylindrical form. Seen from the

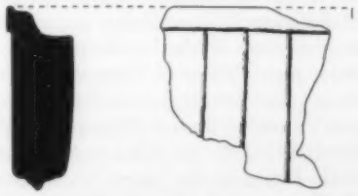

FIG. 10. Grooved fragment from cylinder, Palenque. Rim diameter, 16 cm.

front, however, this shape is almost obscured by a maze of detailed overlay — small figures peering out from scrolls, vinelike or ropelike objects, and other appliquéd ornamentation. The treatment reminds us not of the unity of composition characteristic of the Palenque cylinders but of the florid style of the Copán stelae. In contrast to the principal head at Palenque, the central composition in the Teapa and Tapijulapa pieces consists of a full figure seated on a grotesque head. The ware is similar to Palenque red-brown but of a lighter color. A row of loops, at the back of each flange, provides another correspondence with Palenque (Fig. 8; Cook de Leonard 1954, Fig. 1 *a*; Sáenz 1956, Fig. 5).

Correspondences to the Palenque flanged cylinders can be recognized farther afield, but on different levels of similarity. Thus, at Lake Amatitlán, Guatemala, many flanged incensarios are tubular, open-ended, tall, well-finished, and masterfully modeled (Borhegyi 1958). However, the side flanges are characteristically narrow and interrupted and the decorative style and motifs distinct from those of Palenque. At Chamá in the Alta Verapaz, modeling on certain incensarios is stylistically close to that on the Palenque cylinders (Dieseldorff 1926, Pl. 34), and the hollow flanged tube with superimposed grotesque faces also occurs (Kidder and Samayoa Chinchilla 1959, Fig. 82). However, we do not know of Alta Verapaz specimens which combine these features to form a thoroughly convincing Palenque-like treatment. Scattered occurrences are known from lowland Guatemalan sites of low, completely hollow incensarios or "incense-burner chimneys" with side flanges and single grotesque head (Coe and Broman 1958: 39–40, Fig. 13). But along with other features, their small size and relatively simple decoration distinguish them sharply from the Palenque examples.

Still another level of comparison relates to the twisted eye-nose loop which frequently decorates modeled heads on the flanged cylinders of Palenque. This device occurs on numerous specimens of the incensario class from the Maya area. Some of these have already been mentioned for other resemblances to the Palenque flanged cylinders (Gann 1934, Fig. 6; Dieseldorff 1926, Pl. 34; Kidder and Samayoa Chinchilla 1959, Fig. 82; Coe and Broman 1958, Fig. 13; Blom and La Farge 1926–27, Vol. 1, Fig. 122). Additional incensarios bearing the curled nose element are illustrated by Kidder (1954, Fig. 4 *b*), Proskouriakoff (1946, No. 5), and Kidder and Samayoa Chinchilla (1959, Fig. 86). While these occurrences are important in denoting some kind of symbolic relationship — for example, the appropriateness of depicting the same "jaguar" deity on incense burners — any attempt to evaluate their precise significance must take into account the widespread distribution of the identical eye-nose loop in the Classic Maya sculptures (Spinden 1913, Fig. 1; Proskouriakoff 1950, Figs. 20 *t'*, 32 *k-m*, *o-q*; Thompson 1950, Fig. 12, *13–15*). The problem of historic relationships extends beyond the bounds of ceramic analysis and the incensario cult.

Aside from incense burners, other ceramic objects and stone sculptures can be compared with the flanged cylinders of Palenque. Superimposed masks, which form headdresses, are present on a number of Palenque figurines (Fernández 1943: 57). The same tiered motif is characteristic of stelae at Toniná, Chiapas (Blom and La Farge 1926–27, Vol. 2, Fig. 250; Proskouriakoff 1950, Fig. 47 *b*) and Quiriguá, Guatemala (Maudslay 1889–1902, Vol. 2, Pls. 22, 27, 36, 48). An even more striking correspondence in stone is known from Salinas de los Nueve Cerros, a site on the Río Chixoy in Guatemala (Fig. 11). As on the Palenque cylinders, the principal head, here human, rests on a grotesque face, rather than surmounting a

Fig. 11. Stone sculpture, Salinas de los Nueve Cerros. After Seler 1902–23, Vol. 3, Pl. 1.

body. The headdress includes a second grotesque. The side panels closely resemble the vertical flanges of the Palenque clay tubes. Similarities extend even to the position of the principal head's earplugs as an integral part of the flanking decoration and the profile serpent heads appearing beneath these plugs (Figs. 8, 9, 11; compare Proskouriakoff 1950, Fig. 20 *b*, *c*, *e*, *f*). Similar subjects, sculptured in stone, are also known from Palenque (Ruz Lhiullier 1958a, Fig. 9, Pl. 20; 1958b, Fig. 23 *a*).

Over-all comparison of the flanged pottery cylinders of Palenque with the stone sculptures which have been cited reveals the basic artistic identity of the former with the superimposed mask headdress and flanking frames so common in Maya stela art. It is as if these Palenque "incensarios" substituted as the top portion of a stela. Clearly, this is not to say that their actual function was the same. The correspondences in question may have arisen through the direct influence of Maya sculptural concepts on the ceramic tradition or through the more or less independent portrayal, in different media, of articles of attire actually worn by the Maya. In the latter connection, Thompson (1957: 600), in discussing the flanges which project from the sides of incense burners at Mayapán, states that they "serve as the two-piece frame, usually of featherwork, which was placed behind gods or their impersonators, and which is shown being placed in position on the murals of Bonampak." However this may be, an intimate connection is evident between the Palenque variety of flanged cylinders and the hierarchic aspects of Maya art and accoutrements.

The provenience of the incensarios at Palenque must be considered. The flanged cylinders are generally associated with temple architecture — pyramid platforms and superstructures — to their near exclusion in "palace" architecture or general digging. The remains of eight flanged cylinders were uncovered as an offering within the pyramid of the Foliated Cross (Sáenz 1956: 6), and fragments of this form constitute frequent surface finds at most of the temples which have been cleared. The temple and pyramid of the Inscriptions present a puzzling exception, as the flanged cylinder is rare in the extensive digging conducted there, and sherds of other incense burners are few. This is exemplified by the differing yield of incensario fragments from excavations of equivalent age directly behind the pyramids of the Foliated Cross and the Inscriptions. Both deposits were apparently associated with pottery discarded from these edifices. Whereas approximately two-thirds of the sherds from behind the Foliated Cross relate to the incensario complex — mostly flanged cylinders — excavations behind the Inscriptions revealed an incensario percentage of only three. These figures are based on a yield of some 4000 sherds behind the Foliated Cross and over 12,000 sherds from behind the Temple of the Inscriptions. The same general trends hold true in other digging around these structures. In view of this divergent emphasis, it is interesting that clay figurines, comparatively rare at the Foliated Cross and other Palenque temples, appeared in great numbers from behind the Inscriptions. We are not prepared to interpret the significance of these differences, which may at least in part rest in chance factors. However, some aspect of function, conceivably relating to details of the religious cult, could be involved.

Incense burners have not been found in association with burials at Palenque. This is in contrast to the frequent presence of incensarios as burial furniture at such sites as San Agustín Acasaguastlán (Smith and Kidder 1943: 143), Zaculeu in the Classic Atzán and Chinaq phases (Woodbury and Trik 1953: 191), and, to some extent, the Esperanza phase at Kaminaljuyú (Kidder, Jennings, and Shook 1946: 93, 208, Fig. 201). On the other hand, the pedestal base censer and the flanged cylinder were deposited as offerings in architectural construction at Palenque (Ruz Lhuillier 1952: 42; Sáenz 1956: 6). Incensario fragments of any sort are rarely found away from the ceremonial structures at Palenque. As some of the best stratigraphic data are from non-temple locations, the paucity or absence of particular incensario forms may mean little. A satisfactory sequence of incensario types has yet to be established for Palenque.

Borhegyi has associated several forms of incensarios with a "folk cult" in the highlands of Guatemala (Borhegyi 1951c: 170–1; 1956: 345, 348, 350). These forms appear to be absent or extremely rare at Palenque, where the incensarios which occur seem to us to relate to the hierarchic rather than to the folk aspects of Maya culture. While conclusions along this line cannot be definitive, we are impressed by the physical association of incensarios with the temple deposits and by the symbolism, reminis-

cent of the religious art of the stucco reliefs and stone sculptures, which is strongly developed on the flanged cylinders. Needless to say, these conclusions would carry more weight if it were certain that the flanged cylinders definitely functioned as incense burners. For we have recognized that they may merely have participated, through a sort of secondary convergence, in the incensario tradition.

Summary

1. The great majority of the incensarios in use at Palenque were probably made locally. The same conclusion applies to cache vessels, figurines, and figurine molds, and we seem to be dealing with a valid "ceremonial" ware. To be sure, vessels of a more utilitarian function were also made of this indigeneous red-brown ware. But the absence of the purely ceremonial forms in other wares recovered at Palenque is striking.

2. Of the three major forms comprising the incensario complex of Palenque, the pedestal base censers and the ladle censers were undoubtedly used as receptacles for burning incense. Less certainty as to specific function exists in the case of the hollow flanged cylinders. Perhaps the latter served as semi-permanent stands, set inside temples or at temple approaches, on which small receptacles for burning incense could be placed. But even if, as we consider unlikely, the flanged cylinders were completely separated from incense burning activities, their numerous correspondences to functional incensarios presupposes an important historical relationship. In such a case, it would be necessary to describe the flanged cylinders as examples of a converging tradition, in which historically distinct lines of development, one relating to incense burning, were fused (Thompson 1956: 44).

3. The Palenque incensarios seem to be oriented toward the hierarchal aspects of Maya civilization. In the case of the flanged cylinders, there are pronounced similarities with the symbolism and the manner of portrayal found in Maya monumental art.

4. While the incense burners of Palenque have basic features in common with those of many other regions in Mesoamerica, the Palenque incensarios are, for the most part, markedly distinctive in specific qualities of shape and decoration.

5. Southern Tabasco and the Alta Verapaz especially stand out as regions having close correspondences to the Palenque incensarios. All three regions, interestingly enough, share somewhat similar environmental conditions, being located near the northern escarpment of the highlands. Resemblances noted in the incensarios of these regions are largely, perhaps exclusively, on a Late Classic level.

Acknowledgments. This study is part of a broader investigation of Palenque ceramics. It stems from our field work at Palenque in 1951 and 1956, and from our classification of the abundant ceramic materials obtained in the course of architectural investigations by the Instituto Nacional de Antropología e Historia of Mexico. Support given by the Instituto, the Wenner-Gren Foundation for Anthropological Research, the Institute of Andean Research, the John Simon Guggenheim Memorial Foundation, and the Faculty Research Budget of the University of Mississippi is gratefully acknowledged. We have profited from discussions with Stephan F. Borhegyi of the Milwaukee Public Museum.

Berlin, Heinrich

1956 Late Pottery Horizons of Tabasco, Mexico. *Carnegie Institution of Washington, Publication 606, Contributions to American Anthropology and History*, No. 59. Washington.

Blom, Frans and Oliver La Farge

1926–27 Tribes and Temples, 2 vols. *Tulane University, Middle American Research Series, Publication* No. 1. New Orleans.

Boggs, S. H.

1949 Tlaloc Incensarios in the Baratta Collection, El Salvador. *Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*, No. 94. Cambridge.

Borhegyi, S. F.

1950 Rim-head Vessels and Cone-shaped Effigy Prongs of the Pre-Classic Period at Kaminaljuyu, Guatemala. *Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*, No. 97. Cambridge.

1951a A Study of Three-pronged Incense Burners from Guatemala and Adjacent Areas. *Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*, No. 101. Cambridge.

1951b "Loop-nose" Incense Burners in the Guatemala National Museum. *Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*, No. 103. Cambridge.

1951c Further Notes on Three-pronged Incense Burners and Rimhead Vessels in Guatemala. *Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*, No. 105. Cambridge.

1956 The Development of Folk and Complex Cultures in the Southern Maya Area. *American Antiquity*, Vol. 21, No. 4, pp. 343–356. Salt Lake City.

1958 Aqualung Archeology. *Natural History*, Vol. 67, No. 3, pp. 120–5. New York.

1959 The Composite or "Assemble-it-yourself" Censer: A New Lowland Maya Variety of the Three-Pronged Incense Burner. *American Antiquity*, Vol. 25, No. 1, pp. 51–8. Salt Lake City.

BUTLER, MARY

1935 Piedras Negras Pottery. *University Museum, Piedras Negras Preliminary Papers*, No. 4. Philadelphia.

COE, W. R. AND V. L. BROMAN

1958 Excavations in the Stela 23 Group. *Museum Monographs, Tikal Reports*. No. 2, pp. 23–60. University Museum, Philadelphia.

COOK DE LEONARD, CARMEN

1954 Dos extraordinarias vasijas del Museo de Villa Hermosa (Tabasco). *Yan*, No. 3, pp. 83–104. Mexico.

DIESELDORFF, E. P.

1926 *Kunst und Religion der Mayavölker*, Vol. 1. Julius Springer, Berlin.

DRUCKER, PHILIP

1943 Ceramic Sequences at Tres Zapotes, Veracruz, Mexico. *Bureau of American Ethnology, Bulletin* 140. Washington.

FERNÁNDEZ, MIGUEL ANGEL

1943 New Discoveries in the Temple of the Sun in Palenque. *Dyn*, Vol. 1, No. 4–5, pp. 55–8. Mexico.

GANN, THOMAS

1934 Changes in the Maya Censer, from the Earliest to the Latest Times. *Verhandlungen des XXIV. Internationalen Amerikanisten-Kongresses* [Hamburg, 1930], pp. 51–4. Hamburg.

KELEMEN, PÁL

1943 *Medieval American Art*, 2 vols. Macmillan, New York.

KIDDER, A. V.

1954 Miscellaneous Archaeological Specimens from Mesoamerica. *Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*, No. 117. Cambridge.

KIDDER, A. V., J. D. JENNINGS AND E. M. SHOOK

1946 Excavations at Kaminaljuyu, Guatemala. *Carnegie Institution of Washington, Publication* 561. Washington.

KIDDER, ALFRED II, AND CARLOS SAMAYOA CHINCHILLA

1959 *Art of the Ancient Maya*. Thomas Y. Crowell, New York.

LONGYEAR, J. M., III

1952 Copan Ceramics, A Study of Southeastern Maya Pottery. *Carnegie Institution of Washington*, Publication 597. Washington.

LOTHROP, S. K.

1933 Atitlan, An Archaeological Study of Ancient Remains on the Borders of Lake Atitlan, Guatemala. *Carnegie Institution of Washington, Publication* 444. Washington.

MAUDSLAY, A. P.

1889–1902 *Archaeology. Biologia Centrali-Americana*, 5 vols. London.

PROSKOURIAKOFF, TATIANA

1946 An Album of Maya Architecture. *Carnegie Institution of Washington, Publication* 558. Washington.

1950 A Study of Classic Maya Sculpture. *Carnegie Institution of Washington, Publication* 593. Washington.

RANDS, R. L. AND B. C. RANDS

1957 The Ceramic Position of Palenque, Chiapas. *American Antiquity*, Vol. 23, No. 2, pp. 140–50. Salt Lake City.

RUZ LHUILLIER, ALBERTO

1952 Exploraciones en Palenque: 1950. *Anales del Instituto Nacional de Antropología e Historia*, Vol. 5, No. 33, pp. 25–45. Mexico.

1958a Exploraciones arqueológicas en Palenque: 1953. *Anales del Instituto Nacional de Antropología e Historia*, Vol. 10, No. 39, pp. 69–116. Mexico.

1958b Exploraciones arqueológicas en Palenque: 1954. *Anales del Instituto Nacional de Antropología e Historia*, Vol. 10, No. 39, pp. 117–84. Mexico.

SÁENZ, C. A.

1956 Exploraciones en la Pirámide de la Cruz Foliada y en los Templos XVIII y XXI. *Informes del Instituto Nacional de Antropología e Historia*, No. 5. Mexico.

SELER, EDUARD

1902–23 *Gesammelte Abhandlungen zur amerikanischen Sprach-und Alterthumskunde*, 5 vols. Berlin.

1904 Antiquities of Guatemala. *Bureau of American Ethnology, Bulletin* 28, pp. 75–121. Washington.

SHOOK, E. M.

1954 Three Temples and their Associated Structures at Mayapan. *Carnegie Institution of Washington, Current Reports*, No. 14. Cambridge.

1958 The Temple of the Red Stela. *Expedition*, Vol. 1, No. 1, pp. 26–33. Philadelphia.

SMITH, A. L., AND A. V. KIDDER

1943 Explorations in the Motagua Valley, Guatemala. *Carnegie Institution of Washington, Publication* 546, *Contributions to American Anthropology and History*, No. 41. Washington.

Smith, R. E.

1944 Archaeological Specimens from Guatemala. *Carnegie Institution of Washington, Notes on Middle American Archaeology and Ethnology*, No. 37. Cambridge.

1955 Ceramic Sequence at Uaxactun, Guatemala, 2 vols. *Tulane University, Middle American Research Institute, Publication* No. 20. New Orleans.

Spinden, H. J.

1913 A Study of Maya Art: Its Subject Matter and Historical Development. *Memoirs of the Peabody Museum, Harvard University*, Vol. 6. Cambridge.

Thompson, J. E. S.

1931 Archaeological Investigations in the Southern Cayo District, British Honduras. *Field Museum of Natural History, Publication* 301, *Anthropological Series*, Vol. 17, No. 3. Chicago.

1950 Maya Hieroglyphic Writing: Introduction. *Carnegie Institution of Washington, Publication* 589. Washington.

1957 Deities Portrayed on Censers at Mayapan. *Carnegie Institution of Washington, Current Reports*, No. 40. Cambridge.

Thompson, R. H. (editor)

1956 An Archaeological Approach to the Study of Cultural Stability. In "Seminars in Archaeology: 1955," edited by Robert Wauchope, pp. 31–57. *Memoirs of the Society for American Archaeology*, No. 11. Salt Lake City.

Wauchope, Robert

1948 Excavations at Zacualpa, Guatemala. *Tulane University, Middle American Research Institute, Publication* No. 14. New Orleans.

Woodbury, R. B., and A. S. Trik

1953 *The Ruins of Zaculeu, Guatemala*, 2 vols. United Fruit Company, New York.

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CERAMIC AFFILIATIONS IN THE NORTHWESTERN PLAINS

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ABSTRACT

There are three prehistoric or protohistoric ceramic traditions in the Northwestern plains. The Shoshone tradition is represented by Great Falls ware, found immediately east of the Rockies in central Montana, and probably made by an eastern Plateau tribe. The Pisamiks tradition includes two wares: Ethridge ware in Alberta and northern Montana, probably made by the Blackfoot; Wascana ware in Saskatchewan, closely similar to Selkirk focus pottery in southeastern Manitoba, and probably made by the Cree. The Mandan tradition includes Hagen ware, found along the Yellowstone River in southern Montana, and probably made by the Crow, as well as the pottery made by the Mandan-Hidatsa along the Missouri River in North Dakota.

THE NORTHWESTERN PLAINS (roughly, the High Plains north of the 45th parallel and west of the 101st meridian) have been considered a proverbially potteryless area. In the past, archaeologists in this region have tended to focus on lithic materials which are usually so generalized throughout the Plains for each time period that attempts to infer ethnic affiliations for nonhistoric sites have met with little success. Fortunately for the prehistorian, however, pottery actually does occur in the Northwestern Plains, and is both sufficiently common and distinctive to offer a new avenue for the unraveling of the area's prehistory.

This paper is an attempt to organize the sporadic discoveries of Northwestern Plains pottery into a series of recognizable wares, and to suggest their probable ethnic relationships. I have divided the ceramic types of the Northwestern Plains into four wares belonging to three regional traditions. These are: (1) the Shoshone tradition, represented by Great Falls ware on the western fringe of the Plains; (2) the Pisamiks tradition (a name, from the Blackfoot word meaning "those who hunted far," that I am introducing as preferable to the ambiguous terms, Woodland and Algonkian), occurring as Ethridge and Wascana wares; (3) the Mandan tradition, including recognized Mandan, Hidatsa, and Crow wares, by far the best known of the region's ceramic traditions. It should eventually be possible to separate the sherds of each ware into types which will have a more restricted temporal and areal significance, but at present this can properly be done only for the Mandan tradition wares.

SHOSHONE TRADITION

Sherds of the so-called "Shoshone tradition" are found in campsites, many associated with bison drives, on the western margin of the central Montana Plains as far east as the vicinity of Great Falls (the confluence of the Sun and Missouri rivers), and probably also as far as the Middle Yellowstone River (Mulloy 1952: 136). I have termed this pottery Great Falls ware; its closest affinities appear to lie with the Northern Shoshone (Tuohy 1956), yet it is sufficiently distinct from Idaho wares to remind one that, as Malouf (1956: 152) warns, "some non-Shoshone groups, especially to the north, made flat-bottomed pottery."

The cultural context of the sherds is a generalized Late Prehistoric Plains (Mulloy 1952: 128–37) camp debris of small side-notched arrowpoints, flint knives, scrapers, and bone, worked or only butchered. The locations of the sites agree well with the ethnographic descriptions of the bison hunting forays of the Shoshone, Flathead, and Kutenai along the headwaters of the eastward-flowing streams (Schaeffer 1952: 3). The following description of Great Falls ware is based on a study of 34 selected samples from the collection of Paul Janetski, all discovered within 40 miles of Great Falls. Shumate (1950: 15) reported an equal number of closely similar sherds from the same area.

Great Falls ware ranges from light brown (Munsell 10YR 6/3.75) or brown-gray (10YR 6/1.75) to gray (10YR 3.75/0.75) in color, and in hardness from 3 to 4 on Moh's scale. Upon examination with a hand lens, the coarse, laminated gray or black paste appears to be tempered with coarsely-crushed quartzite, basalt, or sand, with occasional mica inclusions. Evidence of patch construction (each new section of clay smoothed on by the fingers or a rag, then shaped) can be seen in some sherds, and shaping by paddling is probable. Plain sherds of Great Falls ware were wiped smooth while the clay was still damp; other sherds were paddled with a cord-wrapped instrument (the cords 0.5–1.5 mm. thick, some S-twisted), or check-

stamped by means of a roughly-grooved paddle.

The decoration on Great Falls vessels consists of finger indentations or thumbnail notches on the lip and shoulder, diagonal wrapped-rod impressions on the lip, or incising on the body. The incised grooves are one or two millimeters wide, and either parallel to each other or meeting at angles (chevron design); no curvilinear designs were seen.

The shape of Shoshone vessels is distinctive. The flat-based, flaring cylindrical "flowerpot" is a Shoshone trait that contrasts with the rounded-base, composite silhouette vessels elsewhere on the Plains. The flat base has, indeed, come to be used as a hallmark of Shoshone sites, though it may be also characteristic of other eastern Plateau tribes. Not all Great Falls vessels, however, were flat-based: Janetski has found one nearly complete pot with a rounded bottom and straight walls, a simple cylinder. There is considerable variation in wall thickness within one vessel, but the Great Falls sherds average about 6 mm. thick. Straight, rounded rims are frequent, but flattened rims are often found as well.

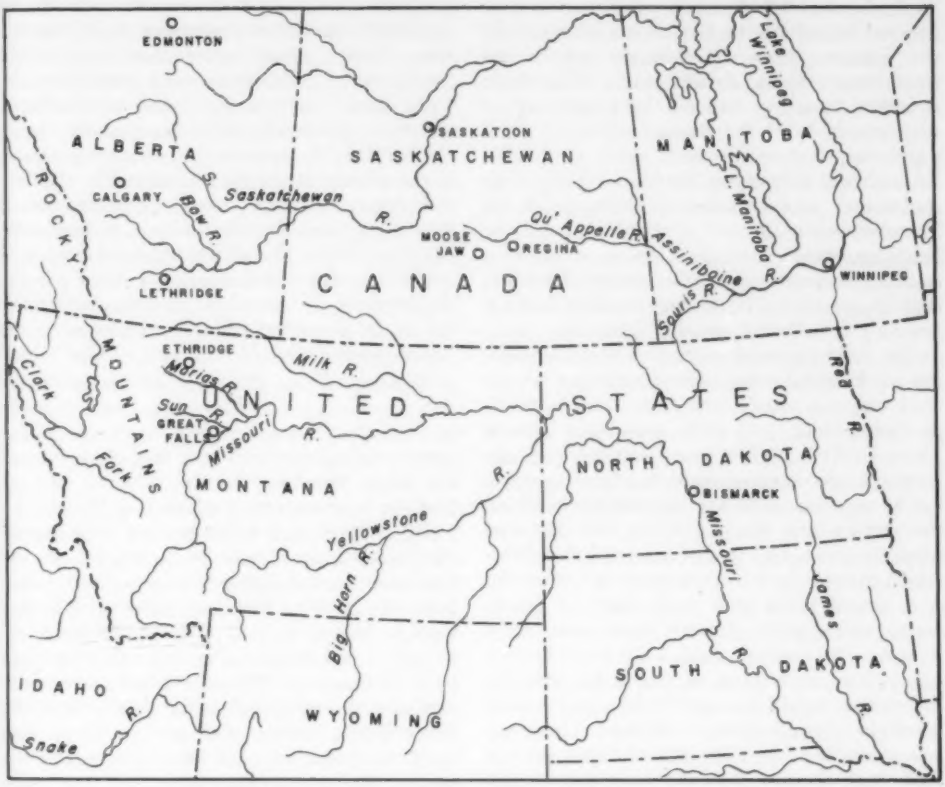
One group of sherds from the Great Falls area (near Ulm, Montana), not included in the above count, differs somewhat from Great Falls ware as described above, and may represent an older ware, since Janetski tells me that there was a preponderance of the earlier large, corner-notched projectile points, and a minority of the Late Period side-notched points in the blowout site with the pottery. The sherds are all rim fragments of a single, rather delicate vessel (walls 4 mm. thick), light reddish brown (5YR 6.75/5.5) to gray (10YR 6.75/1.5) in color and heavily tempered with very fine sand. The exterior surface of the sherds was impressed with S-twist cord 1 mm. thick, placed horizontally and 1 mm. apart. A band of small punctations was made from within the vessel while the clay was still damp, 5–8 mm. below the lip.

Pisamiks Tradition

Ethridge Ware. The Ethridge ware is the northwesternmost pottery on the Plains. The first published description of this pottery was Wedel's (1951) note on sherds from the vicinity of Ethridge, Montana (a few miles east of Cut Bank). The Museum of the Plains Indian, the Glenbow Foundation (Calgary, Alberta), and several private collectors now possess examples of this ware, of which I was able to examine 449 sherds. The distribution of Ethridge ware appears to be from the North Saskatchewan River (the MacGregor collection, from the Edmonton area) south to the drainage of the Marias River in north-central Montana (the type stations, in the Owen, Ortscheid, Leech, and Museum of the Plains Indian collections from 24TL303, 24TL304, and adjacent sites); and east from about longitude 112° west to nearly the Alberta-Saskatchewan border (Forbis's material, in the Glenbow collections, from the Oldman River region, near Lethbridge, Alberta, and also a vessel found near the Battle River northeast of Wainwright, Alberta, and now in the collection of George Sawyer).

In the northern part of this range, around Edmonton, J. G. MacGregor reports that Ethridge sherds are "all found on the surface of sandy blowouts" so that cultural associations are accordingly impossible to determine. In the south, most of the sherds have come from a series of campsites on low knolls below a steep rimrock used for bison drives. The pottery occurs on or near the surface, and is mixed with typical High Plains Late Prehistoric (or Protohistoric) camp debris, such as small side-notched arrowpoints, stone knives, scrapers, broken and charred bone. A buried site, 24TL26, exposed along the Marias River bank in the same county as the Ethridge type stations, contained 14 sherds that Forbis (1958) believed similar to the Ethridge ware in the Oldman River region, although Cooper disclaimed a similarity between these sherds and those Wedel described in 1951 (Cooper 1955: 27). The 24TL26 site yielded, in association with the pottery, worked and unworked stone and bone, remains of bison, dog, deer, elk, antelope and jack rabbit, and hearths, both lined and unlined (Cooper 1955: 27). Other loci for Ethridge sherds have been a stratified campsite, the Ross site northeast of Lethbridge, Alberta, and a cairn, known as the Grassy Lake cairn, both on the Oldman River and both excavated by Forbis.

Ethridge ware ranges in color from gray (Munsell 10YR 3/0 to 2.5Y 7/2) through light brown (10YR 6/1.75 to 6.5/3.5) to light reddish brown (7.5YR 6/4 or 5YR 6/3.75). Its hardness is usually about 3.5 on Moh's scale. The paste is coarse-textured and laminated, dark gray, like most vessel interiors, and tempered with coarsely crushed igneous rock, chiefly quartzite but with some feldspar and often mica



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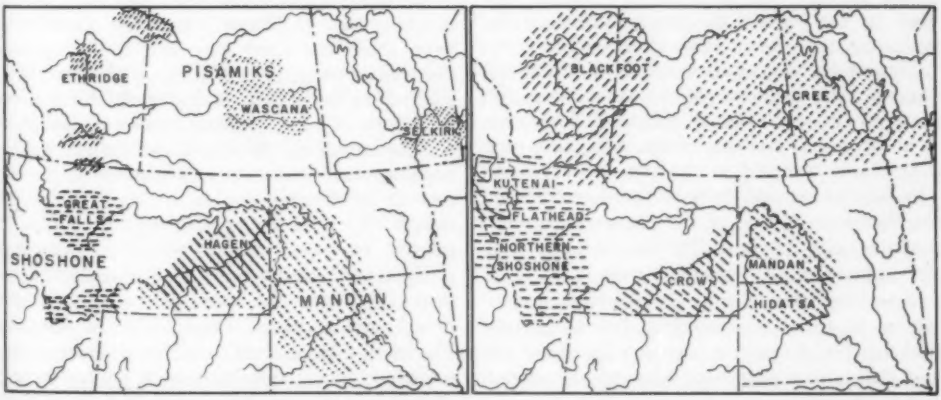

FIG. 1. Map of the Northwestern Plains. *a*, drainage systems and political boundaries; *b*, distribution of ceramic traditions and wares; *c*, distribution of tribal groups at the end of the 18th century.

as well. The vessels were built by the patch method and paddled into shape. The rims were finished by pulling the clay on one side, usually the interior, over the adjacent patch and smoothing it to the desired shape. The single complete vessel, of which I have seen only a photograph, is in the Sawyer collection; it is a globular, short-necked jar 7.5 inches in height, 7.5 inches at its greatest diameter (at the body mid-point), and 6 inches in diameter at the lip, according to Sawyer. Probably, most of the Ethridge vessels were globular or ovoid, with rounded bottoms, frequently carinate shoulders, slightly constricted necks, and straight or moderately everted rims, usually flattened.

The most common method of surface finishing for Ethridge vessels was impressing with a cord-wrapped paddle; the cords were from 0.5 to 3 mm. thick, and while some were twisted (S or Z) fiber or fine sinew, others were untwisted heavy sinew or babiche. Less common, but by no means rare, are plain sherds in which the surface was scraped when the clay had partially dried, and fabric-impressed sherds for which the paddle wrapping was a heavy twined or wrapped fabric with thick single or paired warps and slightly thinner wefts, also often paired. This fabric could well have been a coarse bag, since it appears to lack rigid elements, yet would be too crudely and loosely woven to serve efficiently as clothing. There was one example of a finer twined fabric, neatly made with alternately-paired warps and a single weft, and one small fragment of a possible plain-weave fabric. Whatever type of wrapping was used on the paddle, the entire surface of the vessels seems to have been impressed.

Many Ethridge vessels were left undecorated, although the wrapped-paddle impressions perhaps should be classed as a type of decoration in these cases. For the others, decoration was simple and confined to the rim and shoulder. The designs include lines incised diagonally on the flattened portion of the lip, or on its flattened exterior slope; similar lines produced by the impressions of wrapped rods; a band of punctations below the lip; ball-of-finger indentations or thumbnail notches, less frequently stick notches, along the exterior edge of the lip; and fluting of the lip edge between the thumb and forefingers.

Ethridge ware is utilitarian pottery, for most of the sherds bear carbonized food remains on the interiors. The potters who manufactured it were obviously technically competent, but do not seem to have been interested in, or able to, use their ceramics as a means of artistic expression. Vessel forms, construction and surface treatments of Ethridge ware all conform to the "Woodland" pattern found east of the Plains, and more specifically, Ethridge appears related, through the Wascana ware to which it is closest, to the pottery of the area inhabited by the central Algonkian tribes. But the impression is inescapable that Ethridge ware is a degenerate offshoot of the Woodland tradition and it is interesting that there appears to be a parallel degeneration of "Mandan" tradition pottery, to the south, at its westernmost extension up the Yellowstone River (Mulloy 1952: 132).

Wascana Ware. This second Pisamiks tradition ware is not found, as far as I can discover, in Montana, but lies to the northeast of this state in Saskatchewan. I have tentatively named the ware Wascana, because I have not yet had the opportunity of examining MacNeish's (1958: 69) Selkirk focus pottery and cannot determine how closely it is related to the obviously similar Saskatchewan pottery (MacNeish 1958: 77). My description of Wascana ware is derived from a study of 139 sherds selected as representative of the range of types by J. R. Gagné of Moose Jaw, whose material was part of over 800 classified sherds from the Stony Beach Midden (Moose Jaw area), and by H. K. Cronk, who submitted the bulk of the sample, drawn from the resources of the Saskatoon Archaeological Society.

Wascana ware occurs from Saskatoon in the north at least to Moose Jaw in the south, and from about the 106th meridian in the west to the area south of Lake Winnipeg (Hlady 1949: 93–5; MacNeish 1958: 67) — with the eastern boundary, of course, subject to a more definitive comparison of the Wascana and Selkirk wares. South-central Saskatchewan appears to be the core of its distribution, but it should be noted that northern Saskatchewan has not been adequately explored archaeologically. The sites containing Wascana ware are blowouts, campsites (at Mortlach associated with a bison drive), or "middens" beside lakes or streams. The small side-notched Late Period arrowpoints, scrapers, knives, and charred or broken bones, often of bison, form the associated cultural context.

The ware ranges in color from very dark gray (Munsell 10YR 3/0.5) to pale brown (10YR

6.75/3.75), with a dark brown-gray (10YR 4/1–2) average. Hardness is usually between 3.5 and 4, slightly greater than for Ethridge. The paste is coarse, except for a few waxy-smooth sherds from the Saskatoon area, and is always laminated; most sherds split easily along the junctures within the walls, indicating patch construction. Firing was at the low temperature characteristic of the Northwestern Plains, and produced the same dark-gray paste and interiors noted for the other wares. Gagné, who explains that "as an amateur archaeologist, pottery led me to become an amateur in ceramics," corroborates the inference of low firing temperature gained from the dark color of the sherds by reporting that these "potsherds in my kiln fired to 1800–2000 degrees Fahrenheit become buff or bright reddish."

The aplastic in the Wascana sherds appears under a hand lens to be predominately coarsely-crushed quartzite, occasionally with mica. A few sherds also include fragments of a dark, hard, crystalline rock that superficially resembles mica plates. Gagné informs me that "All the clay soil and most clays of the Plains have the small stones: crushed quartz, quartzite, feldspar, and sand. . . . For my ceramics I have to remove the usual stones. I doubt if the Indians had to add material for temper." The uniformity of aplastic throughout the Northwestern Plains does indeed suggest that much, though probably not all, is a natural component of the raw clay. One distinction of many Wascana sherds is that they are only sparsely tempered, in contrast to the preponderance of moderately tempered sherds in other Plains wares.

Vessels of the Wascana ware were probably all shaped by paddling, although the surfaces of some have been scraped smooth afterward. The potters were able to avail themselves of a variety of materials for wrapping their paddles, and often exercised care in placing the impressions to form a pleasing pattern. Wrapping materials discovered in the sample studied included: (a) cord, 1–3 mm. thick, either S- or Z-twisted where a twist was observable, and probably made of fiber, sinew, babiche, or in one example possibly a thin rolled strip of bark; on a rim sherd from Beaver Creek, south of Saskatoon, wrapped cords (2 mm. thick with wrapping cord 0.75 mm. thick) were placed horizontally over twisted but plain vertical cords (also 2 mm. thick) and irregularly secured by being passed under two or three of the vertical "warps" in a pseudo-weave; (b) twined fabric, like Ethridge twining heavy and flexible enough to have been bags, constructed comparatively crudely and on some pieces probably with paired warps; (c) in at least one instance, a woven fabric with wrapped wefts, the wrapping possibly worn strips of fur, though only 1 mm. wide; (d) woven, twined, and coiled baskets, or on some sherds, perhaps coarse, heavy bags of semi-rigid elements; (e) the most frequent, a close, plain-weave fabric, which on many sherds either was so ragged, or was wrapped so unevenly, that the impressions are easily mistaken for cord-wrapping. A type of paddled pattern that may superficially resemble basketweave, and that was also used by the Wascana potters, is a neat check-stamp from a cross-grooved instrument. The grid is always shallow, but the carving is even and regular. The stamp is placed on the rim, the neck and the shoulder portions as well as on the main body of the vessels.

Wascana potters had a varied repertoire of decorative techniques, but they confined the designs to the vessel rims, neck angles, and shoulder angles. Shoulders exhibited punctations, thumbnail notches, and shallow incised grooving, all as a band along the vessel's greatest circumference. The necks had punctations, thumbnail notches, or a double band of wrapped-rod or wrapped-cord, or of dentate (notched stick) impressions, again as horizontal bands along the point of constriction. Between neck and lip on some vessels were wrapped-cord bands, running horizontally. The lip, generally flattened, exhibits many variations in designs formed of the following elements: impressions of wrapped-rods or -cords, dentate-notched sticks, and fabrics (especially plain-weave and knotted); plain or wrapped stick notches; incised grooves (parallel to the rim, diagonal to it, or both); punctations of reeds, blunt sticks, and pointed tools; and manipulation of the damp clay with the fingers to produce indentations, fluting, and scalloping.

Knowledge of Wascana vessel shapes comes from photographs of five nearly complete vessels from the Saskatoon area, two discovered by Cronk and the other three by an acquaintance of Cronk's, Vigfusson (now deceased). The photographs confirm the inference, suggested by the sherds, that Wascana vessels had globular to ovoid bodies, gently rounded bases

permitting the vessels to stand upright unsupported (perhaps the vessels were built up from shallow, bowl-like discs), well-defined shoulders, and concave neck profiles. All the photographed vessels had cord or fabric-strip impressions running vertically over the entire surface of the body.

These characteristics of Wascana ware clearly relate it to pottery in the territory of the central Algonkian tribes. Like Ethridge ware, the Wascana ware conforms to the "Woodland" pattern, and easily fits into Caldwell's (1958: 31) Northern Tradition. The closest ties appear to lie with southeastern Manitoba pottery assigned to the Selkirk focus defined by MacNeish (1958: 67–71). Ethridge ware is the only closely related pottery to the west of Wascana ware; it reproduces a selection of the simpler characteristics of the Saskatchewan pottery without adding any new traits, and is, in comparison with Wascana, thicker (vessel walls average 8 mm. thick for Ethridge, 6 mm. for Wascana), less carefully paddled, more heavily tempered, and decorated with coarser and simplified designs.

Mandan Tradition

Pottery of the Mandan tradition appears not only along the Upper Missouri's Big Bend region, but also along many tributaries of this great river. In Montana, the Yellowstone River valley is the principal locus of pottery of this tradition, as first demonstrated by Mulloy in 1942. The Yellowstone pottery belongs to a ware best exemplified by Mulloy's extensive collection of sherds from the Hagen site, near Glendive, and therefore deserves to be termed Hagen ware. According to Mulloy (1952: 132), Hagen ware, or at least a closely related type, occurs as far west as the Yellowstone River's approach to the Continental Divide. The southern boundary, Mulloy implies, is the vicinity of the Yellowstone valley, and the northwesternmost occurrences that I know of are a series of campsites along Little Dry Creek, a few miles east of Jordan, Montana (in collections from these sites donated to the Museum of the Plains Indian by Gerald Gibbs, Frank C. Leech, and Mr. and Mrs. Carle Leavitt). The Smithsonian Institution has a collection from site 24RV1, in the Medicine Lake district of the northeastern corner of Montana, that includes a number of sherds with Hagen ware traits (notably a few examples of simple stamping), but also other sherds more closely resembling Wascana ware (particularly, fragments of a cord-wrapped paddled vessel), though none with the fabric impressions so characteristic of the Saskatchewan pottery. Site 24RV1 may thus represent the northern boundary of Hagen ware. To the east, this ware blends into the true Mandan-Hidatsa ceramic complex, which has received ample description (Will and Hecker 1944: 27–69; Cooper 1958: 20–6; Wood 1955: 3–11; Wedel 1957: 97–109). Because the North Dakota manifestations of Mandan tradition pottery have been well described, I shall limit my discussion of it to a comparison between its western variety, Hagen ware (based on Mulloy 1942: 11–38), and the three other wares considered in this paper.

Hagen ware is generally somewhat grayer (lower chroma, in the Munsell terminology) than the typical coloring of pottery of the Pisamiks and Shoshone traditions. The aplastic frequently appears to be a lighter, almost white rock, in contrast to the pinkish or orange quartzite so common in the northern wares. The hardness, firing and construction method of all these Northwestern Plains wares are similar, but the Hagen ware averages thinner than the Ethridge and Great Falls sherds, and in this respect is closest to the Wascana ware. Only Great Falls ware has a true flat base (sometimes slightly flanged), the vessels of the eastern wares using only rounded bases. Mandan tradition vessels frequently have collared or S-profile rims, but neither of these is typical of other Northwestern Plains wares. It is my impression that one of the least common vessel forms at the Hagen site, the type with a hemispherical body and a concave shoulder-to-lip profile (Mulloy 1942: 17, Fig. 8), is far more frequent in the Pisamiks tradition.

It is in surface treatment that the various wares may be most easily distinguished. Hagen ware limits paddle impressions to disparate sections of the vessel — rim, shoulder, basal portion, or even all three sections at once as long as they are slightly separated — and the impressions are either simple stamped (grooved or thong-wrapped paddle) or check-stamped. In contrast, Pisamiks potters covered the entire surface of their vessels, as a general rule, with contiguous paddle impressions, and used a variety of wrapping materials around their paddles to achieve a decorative effect. The Ethridge ware shows the impressions of cords and twined

fabric, but not, in my opinion, of carved paddles. Forbis reports check-stamped sherds with Ethridge sherds in the Grassy Lake cairn, but in view of the aboriginal custom of depositing small offerings at trailside cairns (Mulloy 1952: 133) and of the lack of check-stamped sherds at other Ethridge sites, I do not believe the inclusion of this trait for Ethridge ware is justified. Wascana ware does include check-stamping in addition to cord-impressing and fabric-impressing, and the latter is particularly distinctive for this ware, suggesting the use of coiled, woven, and twined baskets; woven, twined, and possibly wrapped fabrics; and knots that may represent netting. Great Falls ware may be cord-impressed or check-stamped, but apparently not fabric-impressed or simple-stamped. A technological note that distinguishes Great Falls ware plain sherds from those of the other wares is the habit of the Great Falls potters of wiping the surface smooth while the clay was still damp; Pisamiks and Mandan potters preferred to scrape their vessels smooth after they had partially dried.

Non-functional decorations shared by all four wares discussed here are cord- and wrapped-rod (or wrapped-cord) impressions, incising on rims, punctations, lip notching and lip fluting. A diagnostic trait of the Mandan tradition is the rainbow motif, impressed with cords on the vessel rim; horizontal banding below the lip is generally more typical of Mandan wares than of the other Northwestern Plains wares. Brush roughening, repoussé, and appliqué are other uniquely Hagen traits. Pisamiks wares tend to confine decoration below the lip to a simple band of punctations, but this parsimony in decoration may be correlated with the Pisamiks preference for over-all paddle impressions. Hagen and Wascana wares share dentate impressions, but Ethridge and Great Falls ware lack these.

It is interesting that the traits that differentiate the Hagen ware from the others discussed in this paper, particularly the use of simple stamping and the rainbow motif, are those which offer the clearest links between the Hagen site and the Mandan-Hidatsa villages. Conversely, the "extraneous" Hagen traits of wrapped-rod impressions and the concave-neck vessel profile are suggestive of influences from the Pisamiks tradition.

ETHNIC AFFILIATIONS

All the pottery of the Northwestern Plains appears to belong to the Late Period of the Plains (Mulloy 1952: 125), that is, late prehistoric or protohistoric in date. The resemblances of the Northwestern Plains wares are always closest to late prehistoric or protohistoric wares in the surrounding regions (for example, Black Duck focus [Wilford 1955: 136]; Late Prehistoric Mandan). There is nowhere an acceptable association of pottery with any but the small, side-notched, Late Plains projectile point, nor are the sherds deeply buried, except on stream banks. Most of the pottery appears to fall in the last three or four centuries before contact, about A.D. 1800 in the northwesternmost Plains (Wettlaufer 1955: 81; Mulloy 1952: 129–36; Forbis 1958; MacNeish 1958: 67). If this dating is valid, the distributions of the pottery wares should coincide roughly, at least, with the distributions of the early historic tribes in this region. The journals of the early explorers and fur traders in the northern Plains during the latter half of the 18th century are our source for the territories of the tribes, and these journals occasionally even mention the manufacture of pottery by the Indians (as in Burpee 1908: 108, 111).

On the basis of historical accounts and tribal legends, Mulloy (1942: 99–103) has cogently demonstrated the probability of Hagen ware having been produced by the protohistoric Crow, and the Mandan wares of North Dakota have been tied to documented tribal settlements by Will and Hecker (1944). Earlier in this paper I suggested that Great Falls ware was very likely made by an eastern Plateau tribe, such as a Northern Shoshone band, the Flathead, or the Kutenai, since the site locations tally with ethnographic information on hunting forays of these groups.

A movement and "reorientation" of cultural groups similar to that visualized for the ancestral Crow by Mulloy (1952: 133) apparently took place to the north of the Yellowstone also, in the region of the South Saskatchewan River. This reorientation is reflected, I believe, in the slight decline in pottery quality noted by Forbis (1958) at the Ross site near Lethbridge, Alberta. Compare Wedel (1957) for a striking illustration of the decline in Mandan pottery during the last century. Such a reorientation must have been experienced by the protohistoric Blackfoot, and it is therefore significant that the dis-

tribution of Ethridge ware is precisely that of the Blackfoot tribes at the end of the 18th century (Fig. 1). Ewers (1945) has demonstrated that the Blackfoot once manufactured pottery, and we have been told by a Blood informant, Jim Weasel Tail (now aged 59), that as a child he and his friends made model horses out of a particular kind of white clay, from the Belly River Buttes, known in Blackfoot as "really clay" (nitápsaxkut) or "make-buckets-with" (ixtauxáko). Blue and yellow-white clays in the Belly Buttes are also, according to Jim, suitable for "making buckets with." Jim's father, Weasel Tail, remembered that a great-aunt had described to him the method used to make "Indian buckets" out of clay in her youth, and he told his son that if he put the model horse into the ashes of the fire, the heat would make it become red and permanently brick hard. During the last century the Blackfoot made heavy incense burners of sun-dried clay. These thick, round, perhaps mold-made vessels are not true pottery, but informants' accounts of them may easily confuse ethnographers into assuming that ancient Blackfoot pottery was equally crude. On the basis of coincident distributions, Blackfoot memories of pottery making, and parallels between ceramic and cultural relationships, I propose that Ethridge ware represents the pottery of the late prehistoric and protohistoric Blackfoot tribes.

Wilford (1949: 36, 1955: 136) believes that the Headwaters Lake aspect of Minnesota, which includes the Black Duck focus, is the archaeological manifestation of the protohistoric Assiniboine. MacNeish (1958: 79) does not challenge this identification, but adds that the Assiniboine may have been considerably earlier in Manitoba than has previously been thought. Somewhat before the establishment of the fur trade in the northern prairies, at any rate, the Assiniboine joined the Cree, and the two tribes remained closely allied throughout the period of fur trade domination (Hodge 1907: 102–3, 360). At the Rainbow Falls site (C3–UN–1), Manitoba, Hlady (1949: 95) was able to assign "approximately 50 percent of the sherds recovered" to the Laurel (Middle Woodland) and Black Duck (Late Woodland) foci, the latter being presumably Assiniboine, while the "remainder of the pottery. . . appears to tie in with some of the sherds from Saskatchewan whose body finish includes impressions of fabric or a mass of loosely tied knots." Hlady (1949: 93) reported a similar situation at the Lockport site (C3–SA–1) also, in the Red River district southwest of the Rainbow Falls site, although MacNeish (1958: 23) distinguishes a stratigraphic separation. MacNeish (1958: 82) does, however, accept interactions between Cree and Assiniboine reflected in the pottery. The coexistence of these two ceramic wares, Black Duck –Manitoba and Selkirk-Wascana, in Manitoba strongly suggests the historic alliance of the Assiniboine and the Cree, and leads to the conclusion that the Wascana ware must be Cree. The identification is strengthened by the fact that the Cree territory during the 18th century was the land between the Red River of the North and the South Saskatchewan, in southern Manitoba and Saskatchewan (Hodge 1907: 359), precisely the range of Wascana and Selkirk wares. (Mandelbaum [1940: 214] and Kroeber [1908: 150] mention Plains Cree pottery-making, though the technical competence of the potters is hardly indicated.) MacNeish (1958: 67–8) uses another line of reasoning, but reaches the conclusion that his Selkirk focus, with its pottery so closely resembling Wascana ware, was Cree.

Conclusion

The Northwestern Plains encompass three ceramic traditions, each one of which includes manifestations outside the High Plains as well. The Great Falls ware, as part of the Shoshone tradition, should indicate the former extent of the territory used by the Northern Shoshone and allied bands. The Ethridge ware of the Blackfoot and the Wascana ware of the Cree, both belonging to the Pisamiks tradition, may aid in determining the origin of the Blackfoot, the length of time the tribe has resided on the High Plains, and the place of both Blackfoot and Cree in the cultural history of Algonkian speakers. A fuller definition of the Pisamiks tradition should also help in defining the wares of the Mandan tradition, particularly in clarifying problems such as the position of the Cheyenne during their period in North Dakota, and the history of the Crow as reflected in their Hagen ware.

There still remain tribes historically in the Northwestern Plains to whom no ceramic wares can be assigned, for example, the Atsina (Gros Ventres), and others, such as the Assiniboine, whose territory and ceramic style remain a question present data cannot settle. It is possible, for

example, that the rather ambiguous collection from site 24RV1 near Medicine Lake, Montana, represents just one of these unassigned tribes, but it is equally likely that it is a merely fortuitous mixture of Cree and Mandan sherds. Vickers (1949: 85) mentions the occurrence of Black Duck sherds with others exhibiting Upper Missouri "rainbow" cord-impressed rims.

The prime desideratum in Northwestern Plains archaeology is now the controlled excavation of stratified ceramic sites; our goal should be the amassing of a sufficient number of properly documented sherds to permit a typological analysis defining temporally and spatially significant varieties within each ware. When this goal is achieved, not only will tribal movements in the late prehistoric and protohistoric Plains be clarified, but the question of who may have inhabited the earlier non-ceramic sites will have been narrowed to a more promising range of possibilities.

Acknowledgments. The generous cooperation of the collectors, both amateur and professional, in the Northwestern Plains has made this study possible, and I wish to thank, among the former, H. Kenneth Cronk, J. R. Gagné, John and Jean Hodges, J. G. MacGregor, Paul R. Janetski, and Mrs. Marvin Owen; among the latter, Richard G. Forbis, Waldo R. Wedel, and my husband, Thomas F. Kehoe. In addition, I wish to acknowledge the editorial criticisms of Stephen Williams on an earlier draft of this paper, and the advice of Earl H. Swanson on the Shoshone tradition section. Swanson also permitted me to examine notes on Shoshone pottery collected by Osborne and Coale and now at the Idaho State College Museum, Pocatello.

BURPEE, L. J. (EDITOR)

1908 An Adventurer from Hudson Bay (Journal of Matthew Cocking from York Factory to the Blackfeet Country, 1772–3). *Transactions of the Royal Society of Canada*, Ser. 3, Vol. 2, pp. 89–121. Ottawa.

CALDWELL, J. R.

1958 Trend and Tradition in the Prehistory of the Eastern United States. *Memoirs of the American Anthropological Association*, No. 88. Menasha.

COOPER, P. L.

1955 The Archaeological and Paleontological Salvage Program in the Missouri Basin, 1950–1951. *Smithsonian Miscellaneous Collections*, Vol. 126, No. 2. Washington.

1958 Archeological Investigations in the Heart Butte Reservoir Area, North Dakota. *River Basin Surveys Papers*, No. 9, *Bureau of American Ethnology, Bulletin* 169. Washington.

EWERS, J. C.

1945 The Case for Blackfoot Pottery. *American Anthropologist*, Vol. 47, No. 2, pp. 289–99. Menasha.

FORBIS, R. G.

1958 Some Late Sites in the Oldman River Region. MS, to be published by the National Museum of Canada.

HLADY, W. M.

1949 The Archaeology of the Red River of the North and the Whiteshell River. In "Proceedings of the 5th Plains Conference for Archeology," pp. 93–5, *University of Nebraska, Laboratory of Anthropology, Notebook* No. 1. Lincoln.

HODGE, F. W. (EDITOR)

1907 Handbook of American Indians. *Bureau of American Ethnology, Bulletin* 30, Part 1. Washington.

KROEBER, A. L.

1908 Ethnology of the Gros Ventres. *Anthropological Papers of the American Museum of Natural History*, Vol. 1, Part 4. New York.

MACNEISH, R. S.

1958 An Introduction to the Archaeology of Southeast Manitoba. *National Museum of Canada Bulletin* No. 157. Ottawa.

MALOUF, CARLING

1956 The Cultural Connections Between the Prehistoric Inhabitants of the Upper Missouri and Columbia River Systems. MS, doctoral dissertation, Columbia University, New York.

MANDELBAUM D. G.

1940 The Plains Cree. *Anthropological Papers of the American Museum of Natural History*, Vol. 37, Part 2. New York.

MULLOY, WILLIAM

1942 The Hagen Site. *University of Montana Publications in the Social Sciences*, No. 1. Missoula.

1952 The Northern Plains. In *Archeology of Eastern United States*, edited by J. B. Griffin, pp 124–38. University of Chicago Press, Chicago

SCHAEFFER, C. E.

1952 Molded Pottery Among the Kutenai Indians. *Montana State University Anthropology and Sociology Papers*, No. 6. Missoula

SHUMATE, MAYNARD

1950 Archaeology of the Vicinity of Great Falls, Montana. *Montana State University Anthropology and Sociology Papers*, No. 2. Missoula.

TOUHY, D. R.

1956 Shoshoni Ware from Idaho. *Davidson Journal of Anthropology*, Vol. 2, No. 1, pp. 55–71. Seattle.

Vickers, Chris

1949 Manitoba Pottery Types. In "Proceedings of the 5th Plains Conference for Archeology," p. 85, *University of Nebraska, Laboratory of Anthropology, Notebook* No. 1. Lincoln.

Wedel, W. R.

1951 Notes on Aboriginal Pottery from Montana. *Journal of the Washington Academy of Sciences*, Vol. 41, No. 4, pp. 130–8. Washington.

1957 Observations on Some 19th Century Pottery Vessels from the Upper Missouri. *Anthropological Papers*, No. 51, *Bureau of American Ethnology, Bulletin* 164. Washington.

Wettlaufer, B. N.

1955 The Mortlach Site. *Department of Natural Resources, Province of Saskatchewan, Anthropological Series*, No. 1. Regina.

Wilford, L. A.

1949 Archeological Field Work in Minnesota, 1941–1947. In "Proceedings of the 5th Plains Conference for Archeology," pp. 34–6, *University of Nebraska, Laboratory of Anthropology, Notebook* No. 1. Lincoln.

1955 A Revised Classification of the Prehistoric Cultures of Minnesota. *American Antiquity*, Vol. 21, No. 2, pp. 130–42. Salt Lake City.

Will, G. F. and T. C. Hecker

1944 The Upper Missouri River Valley Aboriginal culture in North Dakota. *North Dakota Historical Quarterly*, Vol. 11, Nos. 1–2, pp. 5–126. Bismarck.

Wood, W. R.

1955 Pottery Types from the Biesterfeldt Site, North Dakota. *Plains Anthropologist*, No. 3, pp. 3–12. Lincoln.

Museum of the Plains Indian
Browning, Mont.

January, 1959

34th INTERNATIONAL CONGRESS OF AMERICANISTS

The 34th International Congress of Americanists will meet in Vienna, Austria, July 18–25, 1960. The Organizing Committee consists of Robert Heine-Geldern, President; Josef Haekel and Anna Hohenwart-Gerlachstein, Secretaries; Ferdinand Anders, Treasurer; Etta Becker-Donner, Wilhelm Koppers, and Karl Anton Nowotny, Members. Papers are limited to 20 minutes. No member of the Congress may present more than two papers. Subscription to the Congress is $10.00 for full member, $5.00 for associate member. Institutions and libraries should enlist as full members. Address all correspondence to: 34. Internationaler Amerikanistenkongress, Institut für Völkerkunde, Reitschulgasse 2, Vienna I, Austria.

NEW TRACES OF AN INLAND NEOLITHIC CULTURE IN THE CHUKOTSK (CHUKCHI) PENINSULA

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Abstract

The El'gytkhyn site consists of a cache of stone artifacts and a nearby campsite on the shores of Lake El'gytkhyn on the central Anadyr plateau. The cache contained some 50 artifacts, both knives and points made on large flake-blades and carefully retouched by pressure flaking, and blanks from which they were made. Similar points were found at the campsite along with scrapers and other tools, many retouched chips, prismatic nuclei, and the blades struck from them. Previously, similar artifacts had been found at the Amguema site about 300 km. to the east and the Chirovoe site about 100 km. to the south. The latter is a settlement with pottery as well as stone artifacts. The inland Neolithic culture is compared to the Caribou Eskimo and the Yukaghir, and the El'gytkhyn site is interpreted as the summer hunting camp of people following reindeer to the north from permanent winter villages like the Chirovoe site. The presence of blades removed from prismatic cores, retouched points and other artifacts, tools with graver facets, and pottery in both the Chukchi inland Neolithic and the Paleo-Eskimo cultures suggests movements from the Asiatic to the American Arctic by 4000 years ago.

IN 1953 OKLADNIKOV published an article entitled *First Human Settlement of the Interior of the Chukotsk Peninsula*, in which he discussed the first finds of ancient stone tools in the interior of the Chukotsk (Chukchi) Peninsula. These finds showed that here on the barren tundra, long before the development of a littoral sea-mammal hunting culture by the ancestors of the Eskimo, there had appeared wandering reindeer hunters and fishermen with a fully developed Neolithic culture. These finds were made by N. I. Levoshin on the IAkitikiveem River in the Amguema River drainage,* and also by N. A. Grave near Chirovoe Lake on the Anadyr plateau (Okladnikov 1953; 1955: 124–5).** Two years later new and valuable evidence of the primary settlement of the Chukotsk Peninsula by Neolithic man came to light in the stone tools found by Nekrasov in the spring of 1955 on the shores of Lake El'gytkhyn El'gygytgyn) in the central part of the Anadyr plateau.

* Summarized by Krader (1952).

** Summarized by Chard (1955).

The Anadyr plateau, occupying the central part of the Chukotsk district, lies at the juncture of several large mountain systems. From the south it is approached by the Gydan (Kolyma) range, from the west by the northern and southern Aniuski ranges, and from the north by spurs of the Chukotsk (Anadyr) range. In the beginning of the Quaternary, the Anadyr plateau was a high plain, composed of almost horizontal layers of igneous rock. Today this is a strongly dissected region with elevations up to 500 m., although a few scattered mountain peaks and groups reach altitudes of 100 m. Characteristic of the relief of the Anadyr plateau is the abundance of broad, at times enormous, valleys of large and small watercourses, and the highland plateaus. From the Anadyr plateau rise the largest rivers of the Chukotsk Peninsula, the Anadyr with its tributaries En'muveem and Urumkveem, the Chaun and lesser Chaun, and the rivers of the Kolyma basin, the greater and lesser Aniui. In the mountains of the plateau lie scattered many large and small lakes. Lake El'gytkhyn, which is discussed in this article, is in the northern part of the plateau at 67° 30′ N. Lat. and is not only the largest lake on the plateau, but the second largest lake of the Chukotsk Peninsula (Fig. 1).

Lake El'gytkhyn lies in an inaccessible region, seldom visited even by the Chukchi. It was only discovered in 1932, and had been very briefly visited since by two scientists until 1955, when I. A. Nekrasov, heading an expedition of the U.S.S.R. Academy of Sciences, spent about three months there. Lake El'gytkhyn lies in a mountain basin at an altitude of 490 m. It is 11.5 km. wide, at its greatest diameter with a maximum depth of 169 m. The watershed feeding the lake is not extensive. Only a few small streams supply it with water, the longest of these being 6 km. in length. The mountains surrounding the lake approach the water only on the eastern side. The western, northern, and southern shores have terraces. These reach their greatest width (up to 5 km.) on the western and northern shores. The terrace of the

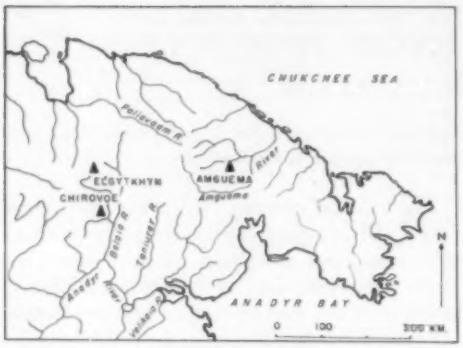

Fig. 1. Distribution of inland Neolithic sites on the Chukotsk (Chukchi) Peninsula.

southern shore is narrow, sloping, in places only 500 m. wide, covered with clayey and sandy soil, swampy, and in contrast to the terrace of the northern and western shore has a distinct escarpment and slope about 4 to 5 m. above the level of the lake.

The region is very cold. In April the mercury not uncommonly drops to -30° C. The mean temperature for May is -8.4° C., and for June it is only 2.6° C. During the first ten days of June the temperature occasionally falls to -5° C. All year around the lake region is distinguished by strong and persistent winds. In the winter the northwest winds blow with great constancy and always bring snow which may continue for several days. During the expedition snowfalls were noted until the first ten days of July. Usually, however, the snow melts before the end of June. The ice begins to form on the lake by the end of September, and apparently breaks up the following August. In some years the ice does not melt entirely and stays for a second winter. The maximum recorded thickness is 2.1 m. In winter, and especially in spring, the lake is often covered by thick fogs.

A direct consequence of the severity of the climate is the sparseness of vegetation. Generally one finds only a few lichens and mosses. In stream valleys and on the southern lakeshore terraces grasses appear; there are scattered scrubby bushes only on the shores of the larger streams. I. A. Nekrasov and his colleagues during their reconnaissances often met herds of reindeer and mountain sheep, foxes and polar foxes, and even brown bears. According to the Chukchi, the lake is rich in fish.

During a reconnaissance of the eastern shore, a projectile point made of hornblende schist and with very well preserved retouch was found on the southwestern slope of a low mountain with bluffs. Only a few meters from where the point was found, a cache, apparently a secret store of stone weapons, was discovered. The cache was found under a large boulder, at a depth of from 0.3 to 0.5 m. The boulder was at an elevation of about 100 m. above the level of the lake, well embedded, as if it had stuck on the irregularities of the slope on its way down. The slope at the cache is at a 20° angle and is wholly covered by waterborn detritus, mostly of a small size. The slope is totally bare of vegetation; only lower down are there patches of mosses and lichens. A temporary stream skirts the boulder on its course, and it had apparently only recently begun to wash away the cache, having brought to the surface the few points which led to the discovery of the rest. The cache was composed of some 50 objects in an area of about 1 sq. m. They were of hornblende schist of various colors ranging from light yellow to brown. There were no fragments in the cache; all the pieces were whole. Of the objects found, 20 are at our disposal [in Leningrad] and are described below. The remaining objects, as well as part of the material from the Lake El'gytkhyn campsite, are to be found in the Anadyr museum. The two collections are closely similar.

Most of the objects from the cache are made on flakes, and could have served as projectile points or knives. They can be divide nto three groups by the shape of their cross sections and other characteristics. Four pieces belong to the first group (Fig. 2 *b-e*). These narrow and massive flakes are of elongated almond shape with a characteristic flat-rhomboid cross section. Two of the points have a symmetrical cross section, so that their broad surfaces are equally convex. Two points have one side flatter than the other. One of these has a wide rounded base, the second has a narrow and sharpened one, while the bases of the third and fourth are cut off by a transverse flake. Both surfaces of the pieces are completely retouched by short but rather wide and deep flakes, the ends of which reach the middle of the piece and meet there, forming a well defined vertical ridge. As a rule these facets have at their beginning a well defined deep negative bulb of percussion, corresponding to the bulb of percussion of the flake removed from that place. All of these artifacts, judging

FIG. 2. Stone artifacts from the Lake El'gytkhyn cache. Length of *b*, 10 cm.

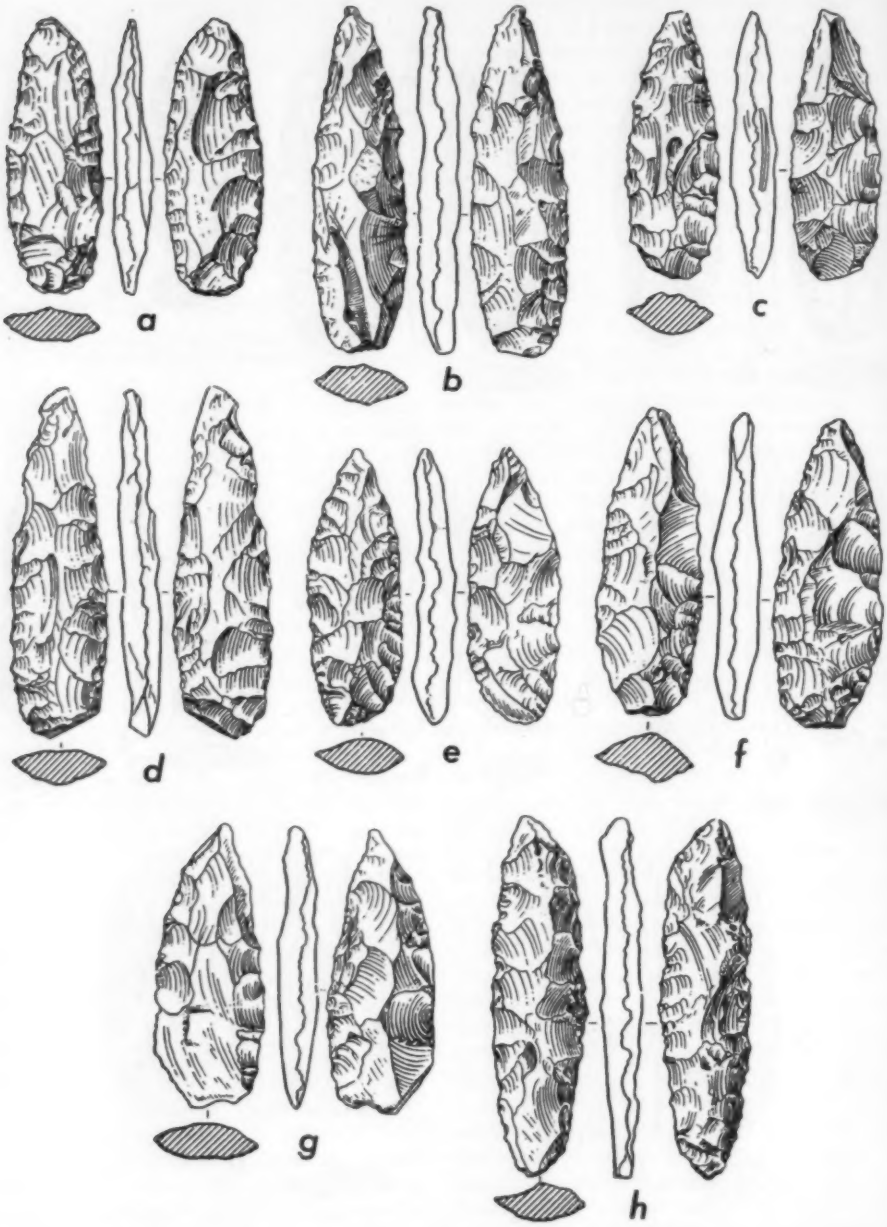

Fig. 3. Stone artifacts from the Lake El'gytkhyn cache and campsite. Length of *f*, 10 cm.

from their form and massiveness, must have been used as points for darts or small spears, which were most likely thrown.

The next six flakes are distinguished from those above only by being less massive (Figs. 2 *a, c, h*, 3 *a, d, g*). Their cross sections are therefore flatter, approximating the shape of a lens. All of them have one broad convex surface, while the opposite one is flatter. Their form is the same elongated almond with more or less of a broad oval base. In three cases, the base is skewed by a sidewise flake. Four of the pieces have retouched edges, two of them lack it completely. The secondary retouching is finely and carefully done. Four of the points have on their sides the remains of the flat surface of the original flake, or of the broad flat flakes from which the blanks were prepared. These are prepared in the same way as the four described above. These six objects could likewise have served as spearpoints or hunting knives.

A special group consists of six flakes, which seem to be blanks, or pieces in the process of manufacture. The first object of this nature has an almond shape and a cross section in the form of a highly flattened lens (Fig. 3 *e*). Both sides of it have had broad flat flakes removed, the edges are wavy and show some secondary retouch. The base, however, preserves wide areas of the surface of the massive flake from which it was made, and on the upper, narrow end is a flat section, showing that the point was not retouched to the end. The remaining four unfinished pieces also share several other characteristics (Fig. 4 *b, c*). The first is that one edge of the flake, all along its length, presents the surface of the original flake, while the opposite side is worked from both sides by retouch, and is thus transformed into a massive cutting edge. The second is the differing character of the two sides of these artifacts. One side is worked with extreme care. It is totally evened out by broad flat flaking, directed from the edges towards the middle. The opposite side is left almost untouched. This narrow surface of the original blade is slightly shaped by several wide flakes, or even only one. One of the four blanks is more carefully finished than the others, so that its second side is retouched, as well as the back of the original flake (Fig. 4 *a*). In terms of the amount of work done on them, the remaining three objects are all of the same kind.

Studying these blanks one can reestablish the exact method of their manufacture and the

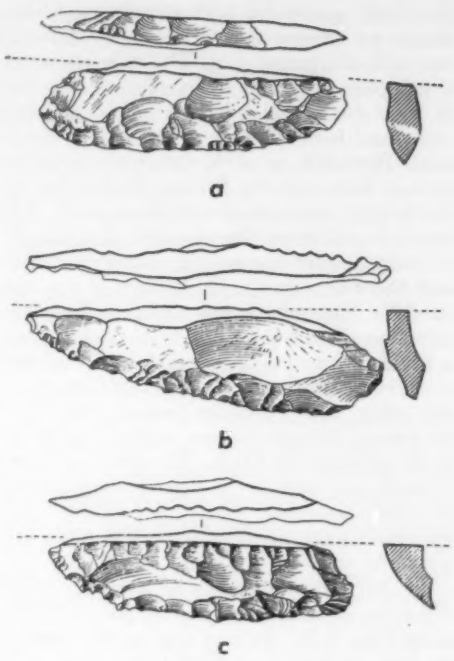

FIG. 4. Stone artifacts from the Lake El'gytkhyn cache. Length of *a*, 10 cm.

operations entailed. The basic material was apparently a specially prepared flake of flinty schist about 10 cm. long and 3 cm. wide. This flake evidently had two wide, more or less parallel, surfaces. The sides had two long narrow ribs, or edges. Setting the piece on one of these edges, the artisan began reworking the upper edge. In this position he first evened one broad surface by flaking, then from this same position he began to remove small and steep flakes from the border of the other surface, converting it into a heavy blade. It is not impossible that the lower border of the tool during this working was enclosed in some sort of vise or crack. Then the tool was reversed, with the finished edge downward, and the same process was repeated. However for some reason or other the four tools here described were not brought to this second stage of manufacture, thus permitting us to see how they were made.

The next group is composed of knives, or more precisely blanks for them, in various stages of completion. Only one approaches completion. The features distinguishing the knives from the objects described above as points are

that they are wider and thinner and their shapes are reminiscent of a strongly flattened oval with sharpened ends. The most characteristic implement of this group is Figure 5 *b*. This flat, leaf-shaped flake, has strongly outbending edges, and both ends are symmetrically sharpened. Both surfaces of the flake are evened out by very wide and flat flaking. Both edges are also in large part worked with the same flat flaking, with additional fine retouch. It is characteristic that here also on one of the sharpened ends there is preserved the surface of the original flake. This is the largest artifact in the whole collection. The second large tool of this group is a wide piece, one surface of which is almost unworked. It was only retouched to form a cutting edge. The opposite surface has been completely, though crudely, worked by the removal of large flat flakes. The object is asymmetrical, one edge being almost straight while the other is convex (Fig. 5 *d*). Three other knife-blanks are partially retouched along the edges and surfaces (Fig. 3 *b*, *c*, *h*).

The last tool from this cache group is a broad oval flake, worked on a blade or piece of flinty schist (Fig. 5 *a*). Part of the smooth surface has been preserved on both sides of the tool.

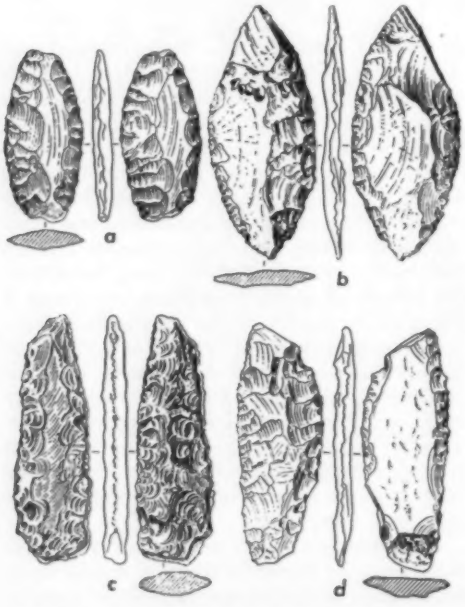

Fig. 5. Stone artifacts from the Lake El'gytkhyn cache and campsite. Length of *a*, 9.7 cm.

The cutting edges of this knife are very carefully retouched. One's attention is drawn to the "opposing" character of this retouching. One edge is formed by very flat flakes, that go far toward the center of the piece. The other edge is covered by short and significantly deeper and narrower facets. The steep retouch on one side of one edge corresponds to the flat retouch on the other side of the same edge, and the same goes for the other edge. Thus the cache under the boulder at Lake El'gytkhyn is a hoard of blanks, left, or more likely intentionally hidden, by some ancient artisan. We may suppose that he intended to return for them, but that something interfered with his intention.

A similar find was made on Kamenoi Island on the lower reaches of the Angara River, where the remains of a workshop of Neolithic times were found, abandoned suddenly in the midst of manufacturing operations. This workshop produced stone blades to set into bone points and various other bone implements. Here, stone tools for cutting and planing bone, prepared cores, blades, broken insets for tools, and other manufactures were found (Okladnikov 1949; 1950: 198–200).

The find at Lake El'gytkhyn differs from that on Kamenoi Island in that the former is not a deserted workshop but a hoard with a distinct character — only stone flake knives and spear points. Both finds are unique for the Stone Age of the Asiatic part of the U.S.S.R. A careful search for other finds around the cache did not unearth anything, but it would be unlikely that the people who left the cache would have lived on such an uncomfortably steep and rocky slope.

On the first terrace, at a distance of about 1.5 km. from the cache, a campsite was subsequently discovered. The surface of the terrace is almost perfectly flat, and about 6 m. higher than the level of the lake. It is composed in large part of sandy gravel and small stones. Such a structure means that the terrace is well drained, covered with mosses which are here and there interrupted by patches of rock. On the southeastern, higher part of the terrace, where the finer sediments apparently settle from the slopes above, the surface is swampy and covered with thick grasses.

On the surface of the dry part of the terrace, amidst the bare patches, a large quantity of chips of flint, obsidian, chalcedony, and hornblende schist was found. Two trenches put in here to the depth of 30 cm. (to the permafrost

level) cut through several hearths at the 20 cm. level in which chips were found in great quantity. Besides these chips over ten fragments of stone tools were encountered on the terrace. There were four prismatic stone nuclei, three of which were complete (Fig. 6 *c*, *d*, *g*). One of them has a typical conical shape, and was made on a small pebble, with part of the cortex preserved on one side. The striking platform has been slanted and bent in and carefully retouched. The second nucleus narrows down only slightly at the end opposite to the striking platform. One side bulges out and is covered with negative bulbs of percussion; the other is flat and carefully pressure flaked. The facets of the retouch are transverse. The striking platform is scarred, that is, slightly convex. The third nucleus is also one-sided. The flat side is somewhat hollow with the cortex remaining, showing that for the manufacture of this nucleus a small pebble was employed. The striking platform is at right angles to the long axis of the piece. It is interesting that the end opposite the striking platform has a second, chisel-shaped platform, formed by fine retouching. The fourth core is a fragment of a larger one of regular prismatic shape, with a round cross section, edged on all sides by the even boundaries of flakes removed. The striking platform of this one is also smooth and carefully retouched.

The blades found at the campsite were made of obsidian, flint (mostly yellow and brown), and semi-transparent chalcedony (Fig. 7 *d-i*). The obsidian blades are rather broad (about 1.5 cm.); the rest are narrow. Two of the obsidian ones are interesting because their ribs have a cross-flake forming a graver facet. The opposite edges of these blades are finely retouched (Fig. 7 *b*, *i*). There are also fragments of retouched blades (Figs. 6 *e*, 7 *k*).

Other items in the collection include the fragmentary bases of two projectile points (Fig. 7 *a*, *j*) of the same type as those described above, two blanks for the preparation of some small tool, perhaps a scraper, and one tool which was either a chisel or an adz (Fig. 3 *f*). This last was made on a schist blade of elongated trapezoidal form. Both of its long straight thin edges

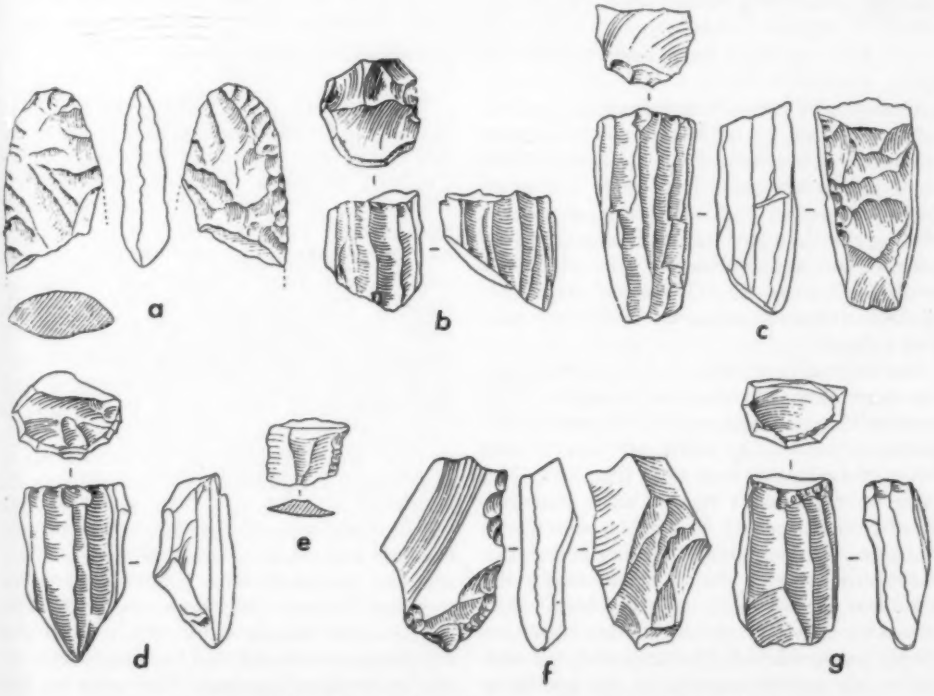

FIG. 6. Stone artifacts from the Lake El'gytkhyn campsite. Length of *c*, 4.8 cm.

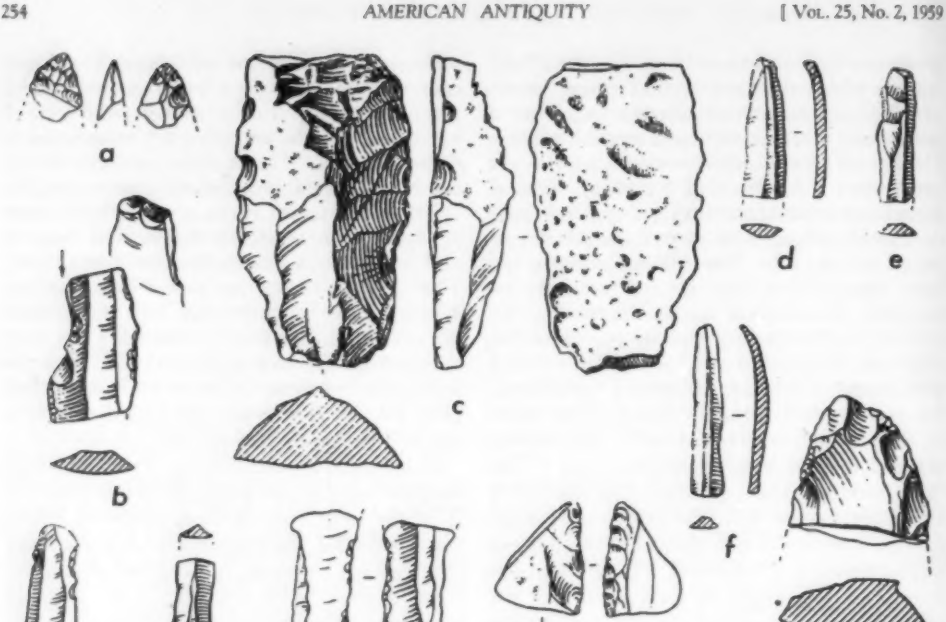

Fig. 7. Stone artifacts from the Lake El'gytkhyn campsite. Length of *c*, 6 cm.

are worked by painstaking retouching, and the edges are slightly straightened out by retouch, producing a sawtooth effect. It is very likely that this artifact could have been used as an adz and smoother without further preparation. Among the chips and fragments there is a fragment of an obsidian projectile point which was made with great skill. There are also a few retouched chips, showing that such chips were also utilized.

An inspection of a gravel slope on the southern shore further to the west, brought to light a splendid knife blade, made of the same hornblende schist, heavily rolled, but with definite traces of working on both sides (Fig. 5 *c*). This knife is of the same type as those described above from the cache. Its shape approaches an elongated triangle. One side is flat and retains the cortex, showing that the material for the knife was either a tablet or a large blade taken from a boulder. The opposite side has been completely pressure flaked. The facets of the retouch are mostly narrow, meeting in the middle to form a well defined central rib.

The finds at Lake El'gytkhyn are first of all remarkable for the light that they throw on the inland Neolithic cultures of the interior of the Chukotsk Peninsula. From the new finds it is evident that this was a fully developed Neolithic culture. The inhabitants of the campsite on Lake El'gytkhyn had fully mastered the technique of detaching a blade from a prismatic nucleus. They performed the finest pressure flaking with equal mastery. We believe that the objects in the Lake El'gytkhyn cache belonged to an ancient artisan who had mastered both these techniques. Perhaps he was a kind of "specialist" in the manufacture of stone tools, as there were specialists in the production of stone tools among various primitive tribes in the recent ethnographic past. We know that the ancient inhabitants of Lake El'gytkhyn had the bow and also throwing spears or daggers. They certainly possessed many other things necessary for domestic life, beginning with stone scrapers and ending with pottery, sherds of which were not found here but which occur on the site at Lake Chirovoe. One must suppose that they also had polished stone tools. The

absence of pottery and polished stone tools among the finds at Lake El'gytkhyn can be explained not only by chance circumstances, or by the fact that the pottery has totally dissolved, but by other reasons tied to the way of life of the ancient inhabitants of the Chukotsk Peninsula.

From this point of view it is of great interest to compare the El'gytkhyn finds with those on Lake Chirovoe, about 100 km. away (Fig. 1). The two regions are connected by the En'muveem River, which flows out of Lake El'gytkhyn. While it would be impossible to spend the winter in the vicinity of Lake El'gytkhyn, conditions are incomparably more favorable on the lower reaches of the En'muveem River. There, from the southward bend of the En'muveem River to its mouth, the valley of the river is abundantly covered with trees and shrubs. It is not amazing, therefore, that the remains of a permanent settlement of Neolithic times, with stone tools and potsherds bearing witness to a lengthy occupation of the site, were found on Lake Chirovoe. Regarding the finds on Lake El'gytkhyn, one must remember that in the summer there appear at Lake Chirovoe immense quantities of mosquitoes, making life almost insupportable for man and beast. The herds of reindeer, fleeing this plague, move into the mountains and to the north, including up the En'muveem River to Lake El'gytkhyn. Following the reindeer, the ancient hunters must also have moved north. There they apparently lived in light above-ground dwellings, tipis, or shelters covered with deer hides. The Lake El'gytkhyn site appears to be the remains of such an encampment.

The obsidian used during the Neolithic for the manufacture of stone tools is found in the vicinity of Lake El'gytkhyn. Hornblende schist and flint are not found there, but only to the north, near the Chukotsk range. This implies that the people who made their tools at Lake El'gytkhyn brought their raw materials from regions lying further to the north, towards the Arctic Ocean. These isolated northern places must therefore have been sufficiently familiar to them. They reached there, one must suppose, during their summer journey following the reindeer, moving from the tundra farther north to the shores of the Arctic Ocean and the mountain areas of the Chukotsk Peninsula. With the coming of the cold the hunters again followed the herds, this time to the south, to the forested regions of the lower En'muveem, where they had their permanent dwellings, of the semi-subterranean type found on Lake Chirovoe by N. A. Grave.

This specialized life of ancient reindeer hunters must recall the life of the Caribou Eskimo, wandering reindeer hunters and fishermen inhabiting the northern part of the American continent, who catch fish in holes in the ice with harpoons and fish-shaped lures. Approximately the same way of life is to be found in descriptions of the ancient way of life of the Yukaghir, likewise hunters of reindeer and fishermen, who only recently inhabited a vast tract of the extreme north of Asia from the Anadyr to the Lena rivers, if not farther. But the reason for the similarity between the ancient and the present-day cultures of northern Asia and North America must not be sought only in environmental similarity as the determining factor in the development of the economy and way of life of the inland hunters and fishermen of these parts.

As archaeological finds bear witness, the most ancient cultures of North America, preceding the developed littoral culture of the sea-mammal hunters, have characteristics strongly relating them to the pre-Eskimo cultures of northern Asia (Collins 1955; Giddings 1949, 1951; Jenness 1941; Knuth 1954; Meldgaard 1952; Nelson 1937). Besides the general similarities of cultures determined by a common way of life and stage of development, there are also similarities between the two continents in a number of specific traits. The first such trait is the broad area of both of these continents in which is found the specialized technique of detaching blades from a prismatic core. The second is the wide distribution of various retouched stone tools in the form of projectile points and knives, scrapers and so forth. The third trait is the appearance of tools with graver facets on both continents. The fourth is the similar pottery, above all the round and pointed bottomed pots with the characteristic check-stamped decoration carried out by means of special paddles with a network of lines carved on them. Although this ornamentation appears only occasionally in the inventory of later settlements of the littoral culture of the Eskimos, it reflects an ancient tradition that has been preserved from the preceding inland hunting and fishing cultures of the arctic and subarctic zones (Oswalt 1953, 1955).

Thus, the new archaeological finds allow us to state more precisely than formerly that by at least 4000 years ago Neolithic tribes, the traces of whose works remain at Lake El'gytkhyn and other places on the Chukotsk Peninsula, had already firmly and widely adapted themselves to these northern climates, the most severe of all in northeast Asia. Moreover, some of these ancient reindeer hunters had even at those distant times crossed the Bering Straits and spread over the northern part of the American continent. These tribes made their contribution to the cultural and ethnic history of the American tribes and also to that of the most ancient inhabitants of Greenland.

This was, apparently, the ethnic-cultural wave with which ethnographers associate the "winter-fishing and reindeer-hunting" cultures and the "Paleo-Eskimo" layer or stage in the history of the most ancient population of northernmost America.

Chard, C. S.

1955 An Early Pottery Site in the Chukchi Peninsula. *American Antiquity*, Vol. 20, No. 3, pp. 283–4. Salt Lake City.

Collins, H. B.

1955 Archaeological Research in the North American Arctic. *Arctic*, Vol. 7, Nos. 3–4, pp. 296–306. Montreal.

Giddings, J. L., Jr.

1949 Early Flint Horizons on the North Bering Sea Coast. *Journal of the Washington Academy of Sciences*, Vol. 29, No. 3, pp. 85–90. Washington.

1951 The Denbigh Flint Complex. *American Antiquity*, Vol. 16, No. 3, pp. 193–202. Salt Lake City.

Jenness, Diamond

1941 Prehistoric Culture Waves from Asia to America. *Smithsonian Annual Report for 1940*, pp. 383–96. Washington.

Knuth, Eigil

1954 The Paleo-Eskimo Culture of Northeast Greenland Elucidated by Three New Sites. *American Antiquity*, Vol. 19, No. 4, pp. 367-81. Salt Lake City.

Krader, Lawrence

1952 Neolithic Find in the Chukchi Peninsula. *American Antiquity*, Vol. 17, No. 3, pp. 261–2. Salt Lake City.

Meldgaard, Jorgen

1952 A Paleo-Eskimo Culture in West Greenland. *American Antiquity*, Vol. 17, No. 3, pp. 222–30. Salt Lake City.

Nelson, N. C.

1937 Notes on Cultural Relations between Asia and America. *American Antiquity*, Vol. 2, No. 4, pp. 267–72. Menasha.

Okladnikov, A. P.

1949 Masterskaia Kamennogo Veka na Ostrove Kamennom-Kezhemskom [A Stone Age Workshop on Kemennyi-Kezhemskii Island]. *Uchenye Zapiski, Leningrad Gosud. Universitet, Seriia Istoricheskikh Nauk*, No. 13, pp. 46–53. Leningrad.

1950 Neolit i Bronzovyi Vek Pribaikal'ia [Neolithic and Bronze Age of the Baikal Area]. *Materialy i Issledovaniia po Arkheologii SSSR*, Vol. 18. Moscow and Leningrad.

1953 O Pervonachal'nom Zaselenii Chelevekom Vnutrennei Chasti Chukotskogo Poluostrova [First Human Settlement of the Interior of the Chukchi Peninsula]. *Izvestiia Vsesoiuznogo Geograficheskogo Obshchestva*, 1953, No. 4, pp. 405–12. Moscow.

1955 *Istoriia IAkutskoi ASSR, Tom I* [History of the Yakut A.S.S.R., Vol. 1], 2nd edition. Moscow.

Oswalt, Wendell

1953 Northeast Asian and Alaskan Pottery Relationships. *Southwestern Journal of Anthropology*, Vol. 9, No. 4, pp. 395–407. Albuquerque.

1955 Alaskan Pottery: A Classification and Historical Reconstruction. *American Antiquity*, Vol. 21, No. 1, pp. 32–43. Salt Lake City.

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Leningrad, U.S.S.R.

December, 1958

EDWARD WINSLOW GIFFORD — 1887–1959

Edward Gifford, who died at Chico, California, on May 16, 1959 at the age of 71, was one of those rare anthropologists who ranged over the broad field and made important contributions in archaeology, mythology, ethnology, kinship, and physical anthropology. In addition to these wide interests, on each of which he wrote substantial monographs, he was a conchologist and ornithologist of note.

From 1904 to 1912 he served as Assistant Curator of Ornithology in the California Academy of Sciences. From 1912 until his retirement in 1955 as Director, he was attached to the Museum of Anthropology at the University of California. In addition to his Museum duties, he was a teacher and during the 43 years of his connec-

(Continued on page 258)

tion with the University he achieved the full professorship notwithstanding the fact that his formal education did not include college attendance.

Throughout his life he worked mainly in the California area. In 1920–21 he was in charge of the Bishop Museum expedition to Tonga; in 1945–46 he engaged in archaeological research in Sonora and Nayarit, Mexico; and in 1947 he embarked on a long-range program of archaeological excavation in Oceania with Fiji as the beginning, followed by New Caledonia in 1952 and ending with Yap in 1956. The Yap report was completed just before his death. Had he lived he would have returned to the Fiji group.

Gifford's interest in the archaeology of California is amply demonstrated by the fact that he published nine major contributions on the subject. In 1915 his first paper on the subject appeared in a brief article, *The San Francisco Bay Shellmounds*, in which he presented a general description of mounds of the San Francisco Bay region, with a valuable discussion of probable population of the Bay shore, and the composition of shellmounds. This was followed in 1916 by a monograph entitled *Composition of California Shellmounds*, which was the first example of the application of a sampling technique which has since become more widely used for determining the constituents of refuse deposits. In this paper the prehistoric ecology is determined and an effort is made to compute the age of shellmounds by estimating the rate of accumulation of the refuse deposits. In 1926 there appeared three papers which treated with prehistoric California materials. First is *Californian Anthropometry*, a major compilation of all available data concerning the physical anthropology of the living California Indians, as well as of all available archaeological skeletal remains. A very useful summary of this large work was printed under the title *California Indian Types* in the same year. Also in 1926 Gifford with W. E. Schenck, then Research Associate of the Department of Anthropology, studied local collections as well as materials in the University Museum of Anthropology and in their joint *Archaeology of the Southern San Joaquin Valley* blocked out the major outlines of the prehistory of the area. Gifford and Schenck succeeded in indicating the relative age of various sites and artifacts types, and concluded that all evidence noted by them dates from the later prehistoric period, but believed that earlier remains could occur in the area and may be found in future.

Gifford's program of a systematic survey and description of the archaeological collections of the Museum of Anthropology is first mentioned in print in his article, *Typology for Archaeology*, published in 1939. In this is a discussion of his system of typological designations using a letter and number code and illustrated with data and conclusions reached by him in his study of shell and bone artifacts from California. He points out the importance of typological cognates used in effecting crossdating, and illustrates this with reference to shell bead types manufactured on the California coast and found in Southwestern archaeological sites. One year later, in 1940, there appeared the volume *Californian Bone Artifacts*. Important in this work is the attention paid to changes of type through time insofar as these can be determined from materials deriving from stratified sites. Also of interest in this report is the comparison of all types represented in mounds of various areas, such as Sacramento Valley, Delta region, San Francisco Bay, South Coast region. At the end of this work Gifford provides the details of the occurrence of Californian shell artifact types from Southwestern sites, a subject to which he returned in two articles appearing in 1949 entitled *Early Central Californian and Anasazi Shell Artifact Types* and *The Cochise Culture Olivella*. In the same year Gifford published an article, *Diet and Age of Californian Shellmounds*, in which he compares the constituents of Fijian and San Francisco Bay shellmound deposits and discusses various possibilities to account for the differences in amount of bone and shell found in the coastal shell heaps in the two areas.

His contributions to Mexican archaeology were published in 1946, 1950, 1952, and 1953. Of these the *Surface Archaeology of Ixtlán del Río, Nayarit* is the most substantial.

All three of the Oceanian excavations were major efforts, and the reports on Fiji, New Caledonia, and Yap are models of careful and complete reporting which set a new high standard for the area.

Gifford was one of the most warmly-loved men in the profession. Kind and always considerate, he was outgoing and friendly. He was a confidant and helper to his students, and always eager to discuss the current research problems of his colleagues. His personal ac-

quaintance with California Indians numbered many hundreds, and few ethnographers have been more generously received and longer remembered by as many informants than Gifford. The present anthropological collections at Berkeley (which are at the moment being installed in a spacious new building) were amassed and cared for during his tenure and they will stand as an enduring record of his devotion to the principle that both the past and the future are a part of current anthropology.

The following bibliography is of Gifford's publications on archaeology and represents about one-fifth of his total writings.

ROBERT F. HEIZER

1915 The San Francisco Bay Shellmounds. *California Out-of-Doors*, Vol. 1 (April), p. 29. San Francisco.

1916 Composition of California Shellmounds. *University of California Publications in American Archaeology and Ethnology*, Vol. 12, No. 1, pp. 1–29. Berkeley.

1926 California Indian Types. *Natural History*, Vol. 26, No. 1, pp. 50–60. New York.

Californian Anthropometry. *University of California Publications in American Archaeology and Ethnology*, Vol. 22, No. 2, pp. 217–390. Berkeley.

Archaeology of the Southern San Joaquin Valley, California. With W. E. Schenck. *University of California Publications in American Archaeology and Ethnology*, Vol. 23, No. 1, pp. 1–122. Berkeley.

1928 Pottery-Making in the Southwest. *University of California Publications in American Archaeology and Ethnology*, Vol. 23, No. 7, pp. 353–73. Berkeley.

1935 Note on Pottery-making in the Southwest. *American Anthropologist*, Vol. 37, No. 3, p. 535. Menasha.

1937 Stoppers or Modeling Tools. *American Antiquity*, Vol. 2, No. 3, p. 207. Menasha.

1940 Californian Bone Artifacts. *University of California Anthropological Records*, Vol. 3, No. 2, pp. 153–237. Berkeley and Los Angeles.

1946 Archaeology of the Punta Peñasco Region, Sonora. *American Antiquity*, Vol. 11, pp. 215–21. Menasha.

1947 Californian Shell Artifacts. *University of California Anthropological Records*, Vol. 9, No. 1, pp. 1–132. Berkeley and Los Angeles.

1948 Typology for Archaeology. *Vigesimoséptimo Congreso Internacional de Americanistas, Actas de la Primera Sesión, Celebrada en la Ciudad de México en 1939*, Tomo 2, pp. 7–11. Mexico.

1949 Diet and the Age of Californian Shellmounds. *American Antiquity*, Vol. 14, No. 3, pp. 223–4. Menasha.

Early Central Californian and Anasazi Shell Artifacts Types. *American Antiquity*, Vol. 15, No. 2, pp. 156–7. Menasha.

The Cochise Culture *Olivella*. With D. S. Gifford. *American Antiquity*, Vol. 15, No. 2, p. 163. Menasha.

Excavations in Viti Levu. *Journal of the Polynesian Society*, Vol. 58, pp. 83–90. Wellington.

1950 Surface Archaeology of Ixtlán del Río, Nayarit. *University of California Publications in American Archaeology and Ethnology*, Vol. 43, No. 2, pp. 183–302. Berkeley and Los Angeles.

1951 Archaeological Excavations in Fiji. *University of California Anthropological Records*, Vol. 13, No. 3, pp. 189–288. Berkeley and Los Angeles.

A Program for Micronesian Archaeology. With K. P. Emory and others. *American Anthropologist*, Vol. 53, No. 4, pp. 594–7. Menasha.

1952 Archaeological Sites on Opposite Shores of the Gulf of California. With W. E. Schenck. *American Antiquity*, Vol. 17, No. 3, p. 265. Salt Lake City.

A Carbon-14 Date from Fiji. *Journal of the Polynesian Society*, Vol. 61, Nos. 3–4, p. 327. Wellington.

Expédition Archéologique de l'Université de Californie en Nouvelle-Calédonie. With Dick Shutler, Jr. *Etudes Mélanésiennes*, n.s., 5e année, No. 7, pp. 19–24. Noumea.

1953 Re Archaeology of the Galapagos Islands. *American Antiquity*, Vol. 19, No. 2, p. 171. Salt Lake City.

L'Archéologie Néo-Calédonienne en 1952. *Journal Société des Océanistes*, Vol. 9, pp. 64–70, 73–4. Paris.

1955 Six Fijian Radiocarbon Dates. *Journal of the Polynesian Society*, Vol. 64, p. 240. Wellington.

1956 Archaeological Excavations in New Caledonia. With Dick Shutler, Jr. *University of California Anthropological Records*, Vol. 18, No. 1, p. 1–148. Berkeley and Los Angeles.

FACTS AND COMMENTS

ECOLOGICAL INTERPRETATIONS AND PLANT DOMESTICATION

Abstract

Ecologically oriented studies in anthropology can be improved by greater familiarity with standard botanical and agricultural sources (many of which are listed in this paper) on the enumeration, classification, domestication, and use of culturally significant plants.

ECOLOGICALLY ORIENTED APPROACHES, such as that discussed in recent issues of this journal by Meighan and others (1958), deserve strong support, not only in archaeology but also in other fields of anthropology. In the interests of furthering research of this type, and with particular regard to the study of plant domestication, I would like to draw attention briefly to three matters which seem to require some clarification. These concern (1) the enumeration of domesticated plants, (2) the specification of such crops, and (3) standard sources of information on plant domestication.

Enumeration of Domesticated Plants

In the second part of the article mentioned above, there is a five-page chart (Table 1) in which "240 species" (p. 140) are tabulated and checked for occurrence in six New World and four Old World regions in "an attempt to list all known cultivated plants and the evidence for their presence in various areas of the world, . . ." (p. 139). There are many small errors in the list. Of more general concern is the omission of many important Eurasian cultigens and food crops such as taro (*Colocasia esculenta*), sorghum (*Sorghum vulgare*), ragi (*Eleusine corocana*), foxtail millet (*Setaria italica*), and Job's-tears (*Coix lachryma-jobi*). Such gaps, together with the absence of any consideration of Africa or Oceania, have probably already suggested to many readers that this listing might easily be augmented. That a very considerable expansion is possible can be seen by noting the way similar attempts have been handled by authors who have been more directly concerned with plant materials.

Though now recognized as an oversimplified statement of the many problems involved, de Candolle's *Origine des plantes cultivées*, first published in 1883, does contain an early, yet detailed account of "247 species" (Candolle 1959: 447–8) of important cultivated crops. Merrill (1954: 196) gives an offhand estimate of 400 as the number of "different species of cultivated food plants." Counting only those main crops found in his eight "ancient centers of origin," Vavilov (1949–50: 44) lists "640 most important cultivated plants," adding that "if the calculation were based on the exact number of species, the number of plants would be much larger. . . ." A published selection of Sturtevant's voluminous agricultural and botanical notes (1919) includes data on 2897 edible plants "most of which are cultivated" (Hedrick 1919: v). In three volumes on the useful and cultivated species in the East Indies, Heyne (1927) describes the treatment of some 3000 plants. And Bailey, in a compact manual dealing with the cultivated plants "most commonly grown in the continental United States and Canada" (1949: 3), provides main entries for 5347 species. In a more inclusive and less regionally-restricted —though admittedly partial—encyclopedia, Bailey (1922) accounts for 20,602 cultivated species. Including main varieties as well as species, Bailey and Bailey (1941) supply valuable information on 31,905 cultivated plants in North America.

While different estimates and enumerations of this sort reflect different classificatory criteria and varying interests of different authors (agriculturists, foresters, horticulturists, taxonomists, ethnobotanists, or phytogeographers), it is inescapable that prehistoric and subsequent plant domestication has involved many more plant segregates than we in anthropology, at least, may commonly have supposed. Even if only taxonomically valid species (not subdivisions of species) were tallied, a full global roster of *all* plant domesticates as of A.D. 1500 would still run to over 1000.

The origins and stages of domestication of all but a very few of these plants (such as the dominant European grains; see Helbaek 1953, 1959) are very poorly understood (Anderson 1952: 152–3). However, for investigations of this important cultural process, whether by archaeologists or others, the comparatively rich botanical literature on the geographic and taxonomic classification of the world's regional floras is a necessary starting point. Thus, in identifying or listing botanical entities it is helpful — and in many cases essential — to know what kind of classification or enumeration is being made.

Specification of Plant Domesticates

For accurate documentation, useful or cultivated plants are usually identified in terms of either a folk or a scientific taxonomy. With regard to archaeological evidence, only the latter can be employed systematically. In the nonbotanical literature, however, the two systems are often used together with the implication of some kind of synonymy or translation equivalence between the two systems. This has led to frequent, though less frequently recognized, misinformation (for example, in the chart referred to above, "*Dioscorea* sp." is equated with "Sweet potato"; the technically-used common name for species of that genus is "yam," which is sometimes popularly applied to *Ipomoea batatas* as well, but "sweet potato," technically or popularly, is associated only with the latter binomial).

For obvious reasons, especially for wide national or international usage, attempts to employ only "standardized" common names (for example, Kelsey and Dayton 1937) have not met with universal acceptance. Because of the numerous subspecific varieties found in any agricultural crop inventory, even the relatively rigid botani-

cal taxonomy is faced with many problems. Standardization procedures with special regard to these difficulties are outlined in a recent publication of the International Commission for the Nomenclature of Cultivated Plants (1958). An excellent general discussion of nomenclatural problems is provided by Lawrence in his *Taxonomy of Vascular Plants* (1951, Chap. 9).

Another important research aid in solving problems of plant specification is Roon's "International Directory" (1958) which not only lists the names, addresses, and interests of botanical specialists, but also indicates their willingness to determine specimens and provide information about particular taxonomic groups and geographical areas.

When an enumeration of botanically distinct cultivated plants is of interest in comparative work, it is important to specify the taxonomic level (generic, specific, subspecific) at which a count is taken, and to avoid unnecessary mixing of levels. In this regard, the nonspecialist can save much time and effort by consulting such references as Willis's *A Dictionary of Flowering Plants and Ferns* (1931) and the texts by Robbins (1931) and Hector (1936) on crop botany. For many countries and for particular geographical areas there are extensive botanical treatments which include descriptions of the local cultivated flora. A handy annotated guide to many of these references is furnished by Lawrence (1951: 290–301) in a special section on "Regional floras and manuals."

Standard Sources

In addition to strictly regional studies on economic and taxonomic botany, there are a number of sources which systematically discuss and organize large portions of the general literature relevant to the study of plant domestication from a cultural as well as a biological point of view. Those which I have found to be of greatest help in meeting the needs of ecologically oriented archaeologists and ethnobotanists are included in the references below. For example, the Burkill "Dictionary" (1935) — despite its modest title — is a classic general source of anthropological and agricultural information on a large share of the domesticated flora of the world.

Bibliographically, there are two excellent and easily available sources of information on numerous topics related to plant domestication. The first is the U.S. Department of Agriculture Library's *Bibliography of Agriculture* (published monthly since 1942). Its extensive indexing often includes headings such as "shifting cultivation" and "human ecology" along with the names of hundreds of specific crops and farming practices. The second source, also compiled by the U.S.D.A. Library, is the recently completed 15-volume *Botany Subject Index* (1958). In it, all plant and plant science references in the Department of Agriculture Library card catalogue are photographically reproduced in an indexed, topically-arranged order.

The anthropologist's study of plant domestication and agricultural ecology is greatly facilitated by these references. Any further research on the evidence of man's special use of plants cannot help but profit from a familiarity with these sources and a close examination of the contributions of such men as Ames, Burkill, and Vavilov.

Ames, Oakes

1939 *Economic Annuals and Human Cultures.* 159 pp. Botanical Museum of Harvard University, Cambridge. [Reprinted, 1953.]

Anderson, Edgar

1952 *Plants, Man and Life.* 245 pp. Little, Brown, Boston.

Bailey, L. H.

1922 *The Standard Cyclopedia of Horticulture,* 2nd edition (6 vols.). 3639 pp. Macmillan, New York.

1949 *Manual of Cultivated Plants Most Commonly Grown in the Continental United States and Canada,* revised edition. 1116 pp. Macmillan, New York.

Bailey, L. H. and E. Z. Bailey

1941 *Hortus Second, a Concise Dictionary of Gardening, General Horticulture and Cultivated Plants in North America.* 778 pp. Macmillan, New York.

Bois, D.

1927–1937 *Les plantes alimentaires chez tous les peuples et à travers les âges* (4 vols.). Lechevalier, Paris.

Burkill, I. H.

1935 *A Dictionary of the Economic Products of the Malay Peninsula* (2 vols.) 2402 pp. Oxford University Press, London.

1953 The Hooker Lecture: Habits of Man and the Origins of the Cultivated Plants of the Old World. *Proceedings of the Linnean Society of London, 164th Session (1951–52),* Vol. 164, Part 1, pp. 12–42. London.

Candolle, Alphonse [Louis Pierre Pyramus] de

1959 *Origin of Cultivated Plants* [offset reprint of the 2nd edition of 1886]. 468 pp. Hafner, New York.

Council of Scientific and Industrial Research

1948 *The Wealth of India — A Dictionary of Raw Materials and Industrial Products* (6 vols. to date). Government of India, New Delhi.

Dalziel, J. M.

1937 *The Useful Plants of West Tropical Africa.* 612 pp. Crown Agents for the Colonies, London.

Dressler, R. L.

1953 The Pre-Columbian Cultivated Plants of Mexico. *Harvard University, Botanical Museum Leaflets,* Vol. 16, No. 6, pp. 115–72. Cambridge.

Haudricourt, A. G. and Louis Hédin

1943 *L'homme et les plantes cultivées.* 233 pp. Gaillimard, Paris.

Hector, J. M.

1936 *Introduction to the Botany of Field Crops: Cereals* (Vol. 1), *Noncereals* (Vol. 2). 1127 pp. Central News Agency, Johannesburg.

Hedrick, U. P.

1919 Sturtevant's Notes on Edible Plants. *27th Annual Report of the State of New York Department of Agriculture,* Vol. 2, Part II, 686 pp. J. B. Lyon, Albany.

Helbaek, Hans

1953 Archaeology and Agricultural Botany. *Ninth Annual Report of the University of London Institute of Archaeology,* pp. 44–59. Institute of Archaeology, London.

1959 Domestication of Food Plants in the Old World. *Science,* Vol. 130, No. 3372, pp. 365–72. Washington.

Heyne, K.

1927 *De Nuttige Planten van Nederlandsch Indië,* new edition (3 vols.) 1662 pp. Ruygrok, Batavia.

International Commission for the Nomenclature of Cultivated Plants of the International Union of Biological Sciences

1958 International Code of Nomenclature for Cultivated Plants. *Regnum Vegetabile*, Vol. 10, pp. 1–28. International Bureau of Plant Taxonomy and Nomenclature, Utrecht.

Kelsey, H. P. and W. A. Dayton (editors)

1942 *Standardized Plant Names*, 2nd edition. 675 pp. J. Horace McFarland, Harrisburg.

Lawrence, G. H. M.

1951 *Taxonomy of Vascular Plants*. 823 pp. Macmillan, New York.

Meighan, C. W., D. M. Pendergast, B. K. Swartz, and M. D. Wissler

1958 Ecological Interpretation in Archaeology: Parts I and II. *American Antiquity*, Vol. 24, No. 1, pp. 1–23, and No. 2, pp. 131–50. Salt Lake City.

Merrill, E. D.

1954 Review of *Plants, Man and Life*, by Edgar Anderson. *Ceiba*, Vol. 4, No. 3, pp. 196–8, Tegucigalpa, Honduras.

Robbins, W. W.

1931 *The Botany of Crop Plants, A Text and Reference Book*, 3rd edition, revised. 639 pp. Blakiston's Son and Co., Philadelphia. [Reprinted, 1936.]

Roon, A. C. de

1958 International Directory of Specialists in Plant Taxonomy, with a Census of their Current Interests. *Regnum Vegetabile*, Vol. 13, pp. 1–266. International Bureau of Plant Taxonomy and Nomenclature, Utrecht.

Sauer, C. O.

1952 *Agricultural Origins and Dispersals*. 110 pp. American Geographical Society, New York.

Schiemann, Elisabeth

1932 Entstehung der Kulturpflanzen. *Handbuch der Vererbungswissenschaft*, edited by E. Baur and M. Hartmann, Lieferung 15, pp. 1–377. Gebrüder Borntraeger, Berlin.

Sprecher von Bernegg, Andreas

1929–1936 *Tropische und subtropische Weltwirtschaftspflanzen; ihre Geschichte, Kultur und volkswirtschaftliche Bedeutung*. (3 vols.). Ferdinand Enke, Stuttgart.

Sturtevant, E. Lewis

1919 See Hedrick.

U.S. Department of Agriculture Library

1942- *Bibliography of Agriculture*. Published monthly, with annual index by author and subject. Government Printing Office, Washington.

1958 *Plant Science Catalog, Botany Science Index* (15 vols.) 15,040 pp. MICROphotography, Boston.

Vavilov, N. I.

1949–1950 The Origin, Variation, Immunity and Breeding of Cultivated Plants, translated from the Russian by K. Starr Chester. *Chronica Botanica*, Vol. 13, Nos. 1–6, pp. 1–364. Waltham.

Watt, George

1889–1896 *A Dictionary of the Economic Products of India* (6 vols. and index vol.). Superintendent of Government Printing, Calcutta.

1908 *The Commercial Products of India, Being an Abridgment of "The Dictionary of the Economic Products of India."* 1189 pp. John Murray, London.

Willis, J. C.

1931 *A Dictionary of the Flowering Plants and Ferns*, 6th edition, revised. 752 pp. Cambridge University Press, London. [Reprinted, 1955.]

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CEREMONIAL BIRD BURIALS IN SAN FRANCISCO BAY SHELLMOUNDS

Abstract

Burials of condors at two central California coastal sites extend the area of this trait, previously known from burials further south and inland. It was probably a ritual practice from Early horizon times (about 2000 B.C.) onward. Possible connections with bird burial in the Southwest deserve study.

A NEARLY COMPLETE, articulated skeleton of a huge bird was unearthed at a depth of 10 feet 3 inches below the surface at the West Berkeley (Ala 307) shellmound at the mouth of Strawberry Creek in Berkeley, California. The remains have been identified as those of a California condor (*Gymnogyps californianus*). The entire skull, mandible, and most of the postcranial bones were present. The completeness of the remains seemingly implies special burial, perhaps similar to that accorded to humans. A shallow depression had been scooped into the midden deposit and the bird had been placed in it and purposely covered. There were no accompanying grave goods and the bones were not stained with red ocher. A large number of condor bones was also collected at the massive Emeryville shellmound (Ala 309) on Temescal Creek, two miles south along the bayshore from West Berkeley. All of the elements except one were obtained within a small area and apparently belonged to a single individual (Howard 1929: 341). This must originally have been an articulated, more or less complete, skeleton but as much of the Emeryville material was collected during earth-moving operations (Schenck 1926), the position of the bones one to another was apparently not observed.

The California condor is an enormous bird with a wing-spread of 10 or 11 feet. It rivals the Andean condor (*Sarcorhampus gryphus*) for the title of the world's largest living, flying bird. The wandering albatross (*Diomedes exulans exulans*) slightly exceeds these two in wing span but does not approach them in bulk (Murphy 1936: 538). The San Francisco Bay region is at present well beyond the condor's range though it lived in the area until late in the 19th century. Only a few of the great birds still exist in isolated highland localities from southern Monterey County southward. They are protected by law but the species is in grave danger of extinction.

There is ample ethnographic evidence from central and southern California for ritual disposal of large birds killed during ceremonies. The Central Miwok of south-central California held a Condor Dance to celebrate the ritualistic killing of one of these birds (Gifford 1955: 287–8). When the condor was slain its skin was kept for a costume and its body was burned or buried. Burial of eagles in the manner of typical human interments has been reported for some Yokuts groups of the San Joaquin Valley (Driver 1937: 144; Gayton 1948: 29, 52). During the Eagle Ceremony of the southern Californian Indians the central act was the killing of a captive eagle. Its feathers were saved for dancing regalia, while the body was carefully interred

or cremated (Drucker 1937: 40). Ritual eagle slaying and burial accompanied the Mourning Ceremony of the Diegueño (Drucker 1941: 149).

That these observances may be quite ancient is indicated by the finding of interments of large carnivorous birds in prehistoric sites in the central and southern portions of the state. In the lower Sacramento Valley bird burials have been found in Early, Middle, and Late horizon sites (Heizer and Hewes 1940: 591) covering a time span of 4000 years or more. While none of the finds is a complete skeleton, legs, claws, skulls and mandibles occur together frequently suggesting that nearly whole bird carcasses had been buried. An Early horizon site produced a decapitated Bald Eagle, the only instance of this sort recorded for the lower Sacramento Valley (Heizer and Hewes 1940: 591, footnote). The skull of an eagle, carefully prepared for burial, was obtained near Buena Vista Lake in the southern San Joaquin Valley (Kroeber 1951; Gifford and Schenck 1926: 50, Pl. 50). Circular discs of abalone shell were glued over its orbits with asphaltum. The eye sockets of a human skull from the same site were similarly treated. An eagle skeleton was taken from a midden at Point Sal in northern Santa Barbara County (Carter 1941: 219). It had been placed in a grave with a human body along with more than the usual offerings.

The West Berkeley and Emeryville occurrences are the first examples of this practice reported for the San Francisco Bay region. The former site was culturally stratified with the lower level from which the condor bones came equatable with the Early horizon of the lower Sacramento Valley (Wallace and Lathrap 1952). Eight radiocarbon dates had been obtained for different levels in the shellmound (Crane 1956). Two are relevant here: 8-to-9 foot level, 2700±300 years (M–121) and 11-to-12 foot level, 3210±300 years (M–122). As the bird skeleton came from a depth of 10 feet 3 inches, its antiquity falls between the two dates, somewhat nearer the latter. The Emeryville midden contained articles typical of the Middle horizon in its deep levels with some evidence that the very bottom may have been contemporaneous with the Early horizon West Berkeley occupation. The cultural content of the upper Emeryville deposit is more or less standard for Late horizon occupation on the shores of San Francisco Bay (Beardsley 1954: 84). As the provenience of the condor bones at Emeryville is unknown, they cannot be assigned to a definite time period.

The archaeological record for central California, now including the San Francisco Bay region, thus documents the persistence of the practice of ceremonially burying large raptorial birds from at least 2000 B.C. into recent times. For southern California archaeological knowledge is sketchy so that the history of the custom is not known. Whether in the past the birds were killed during performances identical to those recorded for the historic Indians is, of course, unknown. Details of recent aboriginal life cannot be safely projected backward in time, as the specific acts and their functions may have been entirely different. However, careful post-mortem treatment, usually accorded only to humans, when applied to other creatures, implies ritual respect if nothing else.

Birds — macaws, parrots and turkeys — are fairly often found in burial fashion in archaeological sites in the Southwest. A formal interment of a turkey with a large black-on-white jar fragment accompanying it was unearthed at Alkali Ridge (Brew 1946: 121); turkey burials were also found during excavations at Mesa Verde (O'Bryan 1950: 101). Articulated macaw and parrot skeletons were recovered at Pueblo Bonito (Judd 1954: 263–4). All of these birds were held as captives. Their plumage provided feathers for religious paraphernalia, plucked out as needed. Eagles were also kept but a rapid survey of published archaeological materials failed to turn up any references to purposeful interments of these large birds. It sems quite probable that a historical conncetion exists between the Californian and Southwestern practices of bird burial. A detailed comparative study needs to be made, however, before this can be demonstrated.

Beardsley, R. K.

1954 Temporal and Areal Relationships in Central California Archaeology: Part 2. *Reports of the University of California Archaeological Survey*, No. 25. Berkeley.

Brew, J. O.

1946 Archaeology of Alkali Ridge, Southeastern Utah. *Papers of the Peabody Museum, Harvard University*, Vol. 21. Cambridge.

Carter, G. F.

1941 Archaeological Notes on a Midden at Point Sal. *American Antiquity*, Vol. 6, No. 3, pp. 214–26. Menasha.

Crane, H. R.

1956 University of Michigan Radiocarbon Dates I. *Science*, Vol. 124, No. 3224, pp. 664–72. Washington.

Driver, H. E.

1937 Culture Element Distributions: VI, Southern Sierra Nevada. *University of California Anthropological Records*, Vol. 1, No. 2. Berkeley.

Drucker, Philip

1937 Culture Element Distributions: V, Southern California. *University of California Anthropological Records*, Vol. 1, No. 1. Berkeley.

1941 Culture Element Distributions: XVII, Yuman-Piman. *University of California Anthropological Records*, Vol. 6, No. 3. Berkeley and Los Angeles.

Gayton, A. H.

1948 Yokuts and Western Mono Ethnography 1: Tulare Lake, Southern Valley, and Central Foothill Yokuts. *University of California Anthropological Records*, Vol. 10, No. 1. Berkeley and Los Angeles.

Gifford, E. W.

1955 Central Miwok Ceremonies. *University of California Anthropological Records*, Vol. 14, No. 4. Berkeley and Los Angeles.

Gifford, E. W. and W. E. Schenck

1926 Archaeology of the Southern San Joaquin Valley. *University of California Publications in American Archaeology and Ethnology*, Vol. 23, No. 1. Berkeley and Los Angeles.

Heizer, R. F. and G. W. Hewes

1940 Animal Ceremonialism in Central California in the Light of Archaeology. *American Anthropologist*, Vol. 42, No. 4, pp. 587–603. Menasha.

Howard, Hildegarde

1929 The Avifauna of Emeryville Shellmound. *University of California Publications in Zoology*, Vol. 32, No. 2. Berkeley.

Judd, N. M.
1954 The Material Culture of Pueblo Bonito. *Smithsonian Miscellaneous Collections*, Vol. 124. Washington.

Kroeber, A. L.
1951 At the Bedrock of History. *Reports of the University of California Archaeological Survey*, No. 11, pp. 5–10. Berkeley.

Murphy, R. C.
1936 *Oceanic Birds of South America*. Macmillan, New York.

O'Bryan, Deric
1950 Excavations in Mesa Verde National Park, 1947–1948. *Medallion Papers*, No. 39. Gila Pueblo, Globe.

Schenck, W. E.
1926 The Emeryville Shellmound, Final Report. *University of California Publications in American Archaeology and Ethnology*, Vol. 23, No. 3. Berkeley.

Wallace, W. J. and D. W. Lathrap
1952 The West Berkeley Site: A Culturally Stratified Shellmound on San Francisco Bay. MS, on file at Department of Anthropology, University of Southern California, Los Angeles.

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ANCIENT MESOAMERICAN MORTARS, PLASTERS, AND STUCCOS: PALENQUE, CHIAPAS

Abstract

Chemical and microscopic analyses of material from eight structures at Palenque show that mortars, plasters, stuccos, wash coats, and lime-aggregates were used as building units, and extend the distribution of lime-aggregate, known also at Comalcalco, Las Flores, and Uxmal.

THE SEVERAL BUILDING ELEMENTS, mortars, plasters, stuccos, wash coats, and lime-aggregates, discussed in previous papers in this series (Littmann 1957, 1958, 1959), were all found present in the structures examined at Palenque. The presence of lime-aggregate at this site as well as at Comalcalco, Las Flores, and Uxmal extends the area of its use.

The surface-coating elements at Palenque are characterized by strength, hardness, high density, and, in many cases, very smooth outer surfaces. Unless painted or deliberately colored, they are very white. In addition, these elements are often composed of laminates which may number from 2 to 40 per cm. Where such laminates are used, they are considered as plasters from the standpoint of element classification based on functional use though their method of application may be the same as for wash coats. The use of multi-laminate plasters also appears to follow a definite pattern in that adjacent layers are of different color, usually alternating between blue-gray and white with occasional layers of red. The use of wash coats over plaster is fairly common and these are often painted. The plaster laminates, and the wash coats, while easily visible to the naked eye or with very moderate magnification, are, as a rule, so firmly bonded as to be inseparable by ordinary mechanical means. It is believed that such tight bonding could only have been obtained by the application of a slurry with a brush or similar tool. There also is the possibility that some organic material such as eggs or plant extracts were added to the lime to improve bonding as well as strength and ease of polishing the outer surface. The surface-coating elements, and the mortars as well, are singularly free of carbon. Only a few of the many samples examined contained carbon and when observed it was present in very small amounts and in very small particles.

The stone underlying the soil at Palenque is a characteristic dolomite containing essentially equivalent quantities of calcium and magnesium carbonates, and the composition of the building elements, in most cases, reflects this origin. There are, however, several exceptions, notably in the stucco from the Temple of the Sun, a plaster and mortar from the Palace, a plaster from the Temple of the Inscriptions, in two mortars from North Group buildings, and in a mortar from the Temple of the Lion. The deviations from the typical dolomite composition, in which the molar ratio of calcium to magnesium is 1:1, exhibited by the exceptions noted above, are all in one direction as shown by ratios varying between 3.3 and 16.7 (Table 1) which in turn reflect compositions relatively poor in magnesium. While high calcium/magnesium ratios in stuccos could be caused by leaching, this phenomenon is not evident in another North Group stucco nor in other exposed surface coatings with the exception of a plaster in the Temple of the Inscriptions. It is also unusual that only the mortars with a lime-aggregate type composition and a lime-aggregate itself should show ratios differing markedly from the available dolomite. As yet, no satisfactory explanation has been devised for these observations.

Perhaps the most unusual feature observed in the building elements at Palenque is the use of a lime-aggregate in the roof comb structure in a North Group building (Sample 14c) and similar compositions in two mortars (Samples 12 and 16). Such compositions were unexpected in an area so rich in sources of lime for burning. In addition, the lime-aggregate in the roof comb performed the same function as similar compositions at Comalcalco and Las Flores in that it was the monolithic portion of a structure consisting of a lime-aggregate core coated with plaster which in turn was covered with a wash coat. This sequence of building elements comprised the building units found at both Comalcalco and Las Flores. The use of lime-aggregate to form a monolithic mass and at Palenque as a mortar in an area where there was no apparent need to do so, may represent a technique typical of a specific period.

On-Site Observations and Sampling

Because of the large number of samples examined and their diverse nature, the on-site observations have been included with the sample descriptions. The classification of the samples was, in some cases, not as clear-cut as one would wish. While classification was made in accordance with the system described in the initial paper in this series (Littmann 1957), several cases were encountered where a type of building element was used to perform a function outside the one originally assigned to it in the original system. When such cases were found, the functional classification *at Palenque* has been shown as the primary classification and the other known function shown in parentheses. An example will illustrate this procedure. A mixture of earth and lime was used as a mortar at Palenque (Sample 16), whereas a similar mixture was employed as a lime-aggregate at Palenque (Sample 14c), Comalcalco, and Las Flores. The classification at Palenque, therefore, is shown as "Mortar (lime-aggregate)." An extremely thin coat of lime used as a decorative or protective layer over a plaster or lime-aggregate has been designated a wash coat. It is evident that the functional system of classification is quite satisfactory but that the compositions of the several functional elements may vary greatly within and between sites. To avoid confusion, the classifications as finally established in the laboratory have been clearly indicated at the end of each sample description. The classifications are based on the results of the analyses of the samples shown in Table 1. Samples designated (A-) were supplied through the courtesy of G. F. Ekholm.

No. A-5, 6 — Temple of the Cross. This sample was a section of floor 30 mm. thick and consisted of a gray base mortar overlaid with a 9.0 mm. thick white layer of similar appearance which in turn was covered with a wash coat less than 1.0 mm. thick. Both the white and gray layers contained many small, rounded stones or gravel which were removed before analysis. The wash coat could not be cleanly separated for analysis. The entire mass was quite friable though the gray base mortar seemed a little softer than the other layers. From the appearance of the under side of the base mortar, it is probable that it had been laid directly over stone. A small amount of carbon was found in each layer. Classification: A-5, Plaster; A-6, Mortar.

No. 1 — Temple of the Cross. A sample of plaster was taken from the outside of the southwest wall of the central vault. It was 5–6 mm. thick, hard, strong, though somewhat brittle, and could be freely handled without dusting. No carbon was found in the sample. The plaster was highly laminated, one sample showing 40 layers per cm. of more or less alternate white and blue-gray striations. Sections of the laminated material could be separated though individual laminates could not be obtained because of their tight adhesion to the adjacent layer. The blue-gray layers had the same general appearance as a similar, but coarser, laminate observed in a Comalcalco stucco (Littmann 1958, Sample 14b). The whole mass appeared to be composed of a series of wash coats. Classification: Plaster (wash coat).

No. 2a, b — Temple of the Cross. The sample of plaster was taken from the inside of the southwest wall of the central vault. It varied in thickness from 20 to 50 mm. The plaster had a blue design painted on a thin laminate which was underlaid with a thin, pink laminate or paint which in turn had been applied to the base plaster. It was not possible to determine if paint or wash coats other than those listed above had been used. The combined wash coats were about 0.5 mm. thick and were separated from the base plaster

Table 1. Results of the Analyses of Sample from Palenque.

Sample Number	Structure	Classification	Acid Insoluble %	Ca%	Mg%	Acid-Insoluble-Free Basis Ca%	Acid-Insoluble-Free Basis Mg%	Ca/Mg Molar Ratio
A-5	Temple of the Cross	Plaster	3.2	26.1	8.8	26.9	9.1	1.77
A-6	Temple of the Cross	Mortar	9.9	24.5	10.3	27.2	11.4	1.43
1	Temple of the Cross	Plaster (wash coat)	0.8	19.4	14.3	19.5	14.4	0.81
2a	Temple of the Cross	Wash coat	0.7	19.2	14.7	19.3	14.8	0.78
2b	Temple of the Cross	Plaster	1.7	22.8	11.3	23.3	11.5	1.2
3	Temple of the Cross	Mortar	1.1	22.9	11.5	23.1	11.7	1.2
4	Temple of the Sun	Plaster	0.7	19.7	13.5	19.8	13.5	0.88
5	Temple of the Sun	Stucco (plaster)	2.1	35.0	3.9	35.7	4.0	5.4
A-8	Palace	Plaster	3.8	31.0	5.6	32.2	5.8	3.3
A-9	Palace	Mortar	2.8	35.7	2.5	36.7	2.6	8.5
6a	Palace	Wash coat	0.4	17.5	16.3	17.6	16.4	0.64
6b	Palace	Plaster	1.2	18.8	14.5	19.0	14.7	0.78
7	Palace	Plaster	1.3	24.8	10.5	25.1	10.6	1.4
8	Temple of the Sun	Stucco	2.0	34.9	3.3	35.6	3.4	6.7
A-7	Temple of the Inscriptions	Plaster	3.5	36.3	1.3	37.6	1.3	16.7
A-10	Temple of the Inscriptions	Mortar	2.9	32.9	4.4	33.9	4.5	4.5
9	North Group — Temple II	Plaster	2.1	22.9	11.1	23.4	11.3	1.2
10	North Group — Temple II	Mortar	3.6	33.5	3.0	34.7	3.1	6.6
11	North Group — Temple II	Stucco	0.9	28.7	7.8	28.9	7.9	2.2
12	North Group — Temple IV	Mortar (lime-aggregate)	40.8	19.1	3.1	32.3	5.2	3.7
13	North Group — Temple IV	Stucco	0.4	16.2	16.0	16.3	16.1	0.62
14	North Group — Temple V	Plaster (wash coat)	5.7	20.2	12.5	21.4	13.2	0.97
14a	North Group — Temple V	Wash coat	11.1	20.2	11.4	22.7	12.8	1.1
14b	North Group — Temple V	Plaster (wash coat)	16.0	34.6	14.9	41.2	17.7	1.5
14c	North Group — Temple V	Lime-aggregate	26.3	18.7	4.9	25.4	6.7	2.3
15	Temple of the Lion	Plaster	9.0	27.5	6.5	30.2	7.1	2.5
16	Temple of the Lion	Mortar (lime-aggregate)	24.2	24.6	3.5	32.4	4.6	4.2

for analysis. Both the wash coats and base plaster were free of carbon. The plaster was free of lamination. Classification: 2a, Wash coat(s); 2b, Plaster.

No. 3 — Temple of the Cross. The sample of mortar was obtained between the stones of the northeast wall of the central vault. It was very light gray in color, soft, friable, and had a typical limey appearance. No carbon particles were found in the mortar. Classification: Mortar.

No.4 — Temple of the Sun. A sample of plaster was removed from the outer wall of the sanctuary. It was 20-40 mm. thick, hard but friable, and had a characteristic limey appearance. No wash coats or laminations were found, nor was the presence of carbon observed.

No. 5 — Temple of the Sun. Two samples of stucco were obtained from the roof comb. One was hemispherical, 40 mm. in diameter and 25 mm. thick. The other was a piece from a rectangular decoration. The latter consisted of a limey, plaster-like core covered by a wash coat less than 0.5 mm. thick which could not be effectively separated. The core of this sample was used for analysis. No carbon was found in either sample. Classification: Stucco (plaster).

No. A-8 — Palace. The plaster was obtained from the niche in the vault of the northwest section and was 7.0 mm. thick. It consisted of a 1.0 mm. thick, buff-colored inner layer and a 5.0-6.0 mm. thick, white outer layer. The combined layers were very hard, dense, and strong. The thicker layer contained some sand. Neither layer showed the presence of carbon. The layers could not be separated for analysis. The presence of a thin inner layer under a thicker outer one suggests the use of a wash coat under the plaster and perhaps over a mortar. This point could not be definitely established however. Classification: Plaster.

No. A-9 — Palace. The mortar, also from the niche in the vault of the northwest section of the Palace, was unusually dense and hard. It was covered with a 0.5 mm. wash coat, possibly painted, which could not be easily removed. It also contained stone chips and a very small amount of carbon and possibly some sand. The appearance and the properties of this sample raise some question as to its proper classification. Despite lack of information on the detailed history of the sample, it is felt that the classification assigned is probably correct. Classification: Mortar.

No. 6 — Palace. The white, unlaminated plaster removed from the outside of the east wall was 1 to 2 mm. thick and covered with a wash coat less than 0.5 mm. in thickness. The wash coat was very hard and showed evidences of gray (blue) and rose-colored paint. Small segments of the wash coat were cleanly separated for analysis. The remainder was removed from the plaster with sandpaper before the latter material was analyzed. No carbon was found in either sample. Classification: 6a, Wash coat; 6b, Plaster.

No. 7 — Palace. The plaster obtained from the east inside wall of the west gallery was 30 mm. thick and covered with a very thin wash coat showing traces of pink color. It could not be determined whether the color was applied as paint over the wash coat or was the color of the coat itself. The wash coat could not be readily removed for analysis. The underlying plaster was hard, had a limey appearance and a very fine texture free of laminations. Again, no carbon was found present. Classification: Plaster.

No. 8 — Temple of the Sun. The hemispherical sample of stucco (No. 5 above) was free of wash coat and had a limey appearance. Classification: Stucco.

No. A-7 — Temple of the Inscriptions. The unlaminated plaster from the wall of the back room was about 30 mm. thick, hard, dense, white, and strong. There was no evidence of a wash coat though the surface may have been polished. Some weathering appeared to have taken place. Stones in moderate amount were mixed with the lime. Classification: Plaster.

No. A-10 — Temple of the Inscriptions. This sample of mortar, 10 mm. thick, was taken from beneath the stone blocks of the floor. The surfaces of the mortar showed that both sides had been in contact with stone and had probably been used as a leveling coat or cushion. It was crumbly, cream-colored, and mixed with stones, but was free of carbon. Classification: Mortar.

No. 9 — North Group, Temple II. A sample of plaster was taken from the west face of the east column in the center wall. It was 15 mm. thick and coated with a wash coat less than 1 mm. in thickness which, in turn, showed traces of paint and some green incrustations which may have been paint or possibly the remains of fungi or plants. The base plaster was white, hard, and dense, and free of laminations or carbon. Classification: Plaster.

No. 10 — North Group, Temple II. Mortar was taken from between the stones of the west column of the center wall. It was white, crumbly when damp, but hard and strong when dry, though of apparently lower density than its covering plaster and of a coarser texture. Some carbon was present. Classification: Mortar.

No. 11 — North Group, Temple II. A small sample of stucco was removed from the hand of the decoration on the north face. It was 15 mm. thick from front to back and showed traces of red paint. No wash coat was observed. The stucco is white, hard, and strong, and free of laminations and carbon. Classification: Stucco.

No. 12 — North Group, Temple IV. The mortar was taken from between the stones of the exterior side of the west wall. It was yellow-brown when dry and appeared to be a mixture of lime and earth or clay. When dry, it was powdery. Small stones were also present in the mortar which, however, was free of carbon. The acid-insoluble portion of the mortar upon examination under the microscope appeared to be a mixture of light-brown clay and quartz crystals. The stones present were soluble in hydrochloric acid. Classification: Mortar (lime-aggregate).

No. 13 — North Group, Temple IV. The sample of stucco was taken from the exterior of the west wall. In general, it had the same appearance as Number 11 except that it was unpainted. It was also free of carbon and laminations and was very white. Classification: Stucco.

No. 14 — North Group, Temple V. This sample was a loose fragment collected from the roof of the building and was probably a portion of the roof-comb. The stucco consisted of a rather soft, friable, gray core covered with a hard, strong, white plaster free of carbon. The core was nonhomogeneous and contained carbon and many small pieces of red earth or crushed and ground, poorly fired, red pottery. The core could readily be removed from the plaster and crumbled on handling. Its appearance was suggestive of a lime-aggregate composition. Microscopic examination of the acid-insoluble portion showed the presence of brick-colored particles, a cream-colored earth or clay, and opaque quartz crystals.

The plaster had an over-all thickness of about 5 mm. and consisted of an outer laminate about 3 mm. thick underlaid with a wash coat less than 0.5 mm. in thickness which, in turn, covered a laminate about 1.5 mm. thick. The inner or last laminate had been applied over one or two less than 0.5 mm. thick wash coats applied immediately over the core. The sequence of structural elements, lime-aggregate, wash coat, plaster observed in this case was also found in the construction of the steps of Temple IV at Comalcalco (Littmann 1957). The outer (3 mm.) laminate and its underlying wash coat were separated by chipping with a knife blade and samples taken for analysis. The remaining segments of the plaster could not be separated and were analyzed in toto. The core was readily removed from the sample with a knife blade. Classification: 14, Plaster (outer, 3 mm. laminate); 14a, Wash Coat (under No. 14); 14b, Plaster (inner laminate); 14c, Lime-aggregate.

No. 15 — Temple of the Lion. The sample of plaster was taken from the rear wall of the lower room. The white, carbon-free plaster had been applied over and around small rounded stones imbedded in a yellowish mortar. It also contained many very small stones which appeared to be fragments of limestone, though these were not very evident on the surface of the plaster which was quite smooth. The quantity, small size, and rounded nature of the stones suggests that sediment, gravel from a stream bed, or possibly a coarse *sascab*, had been used with the lime. The stones are soluble in hydrochloric acid and are probably limestone. The stones were picked out by hand from the sample used for analysis. Classification: Plaster.

No. 16 — Temple of the Lion. A sample of mortar from between the stones in the rear wall of the lower room, when moist, had the appearance of earth. From its location in the wall and the uniformity of its appearance throughout, it seems very doubtful if any soil intrusion had taken place. When dry, the mortar was yellowish and powdery. It was mixed with many rounded stones, larger than those observed in the plaster from the same area, but free from carbon. The cross section of a dried sample was very porous and sponge-like in appearance with many tubular holes all oriented in the same direction. For analysis, the sample was freed from stones by screening through ordinary window screen. Classification: Mortar (lime-aggregate).

Littmann, E. R.

1957 Ancient Mesoamerican Mortars, Plasters, and Stuccos: Comalcalco, Part I. *American Antiquity*, Vol. 23, No. 2, pp. 135-40. Salt Lake City.

1958 Ancient Mesoamerican Mortars, Plasters, and Stuccos: Comalcalco, Part II. *American Antiquity*, Vol. 23, No. 3, pp. 292-6. Salt Lake City.

1959 Ancient Mesoamerican Mortars, Plasters, and Stuccos: Las Flores, Tampico. *American Antiquity*, Vol. 25, No. 1, pp. 117-9. Salt Lake City.

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THE BAHIA-GOA ROUTE IN THE DISPERSAL OF BRAZILIAN PLANTS TO ASIA

ABSTRACT

Although the Portuguese route from Lisbon to Goa via Bahia and Cape of Good Hope was the first direct route from South America to Southeast Asia, it was so little used that it was unimportant in the introduction of American plants into Asia. It is more likely that American plants brought first to Portugal were carried directly from there to Asia.

VERY EXTENSIVE INTRODUCTION of tropical Brazilian species into Indio-Malaysia is clear. Squashes and pumpkins, grain amaranths, peanuts, and popcorns figure in the list of introduced cultigens, as well as such weeds as *Heliotropium indicum* L. and *Mimosa pudica* L. among the less useful plants of obviously Brazilian origin. How such plants were transmitted to Asia is a source of some controversy among botanists and anthropologists alike (Mangelsdorf and Oliver 1951).

Merrill (1954) has recently suggested that the neglected sea-route initiated by the Portuguese in 1500 from Lisbon to eastern Brazil and thence via the Cape of Good Hope to Goa on the Malabar coast of India provides at least part of the answer. His hypothesis that the so-called Bahia-Goa route provided the "perfect set-up for the transmission of Brazilian economic plants and weeds to the Orient" (Merrill 1954: 229) demands some consideration in the light of early Portuguese annals.

The case for the Bahia-Goa route rests on three main points. First, that it was the earliest of the direct post-Columbian routes between South America and Southeast Asia. Cabral's landing at 17° S. Lat. on the eastern coast of Brazil (April 23, 1500), while en route for India, established an American-Asian link 20 years before Magellan's Pacific crossing, and 65 years before the regular galleon line between Acapulco, on the western coast of Mexico, and Manila, on Luzon in the Phillipines, from 1565 through to 1815 and a major source of American plant introduction.

A second point is that the Bahia-Goa route antedated Spanish colonization in Indo-Malaysia by anything from one to six decades. Before 1565, Spanish expeditions had visited the Phillipine Islands on four occasions (1521, 1526, 1527, and 1542). By the earliest of these dates the Portuguese had already established a network of trading contacts throughout Southeast Asia. By 1511 they had established posts at Malacca and Ceylon as well as their bases on the Malabar coast of India. Within a further decade the Moluccas, south of the Philippines, had been reached (1514) and routes extended from the Red Sea to Canton, China (1517).

A third point is that the line from Bahia to Goa was the most traveled of the post-Columbian trade routes. Merrill (1954: 229) writes of "thousands of ships" and "not one or sometimes two ships in a single year like the Acapulco-Manila galleon route, but whole fleets of commercial vessels and sometimes supplementary war ships, year after year."

That the Portuguese were the first to establish a sea-route from South America to South Asia cannot be denied. The point at issue is the assumption that because the Bahia-Goa route existed it was in fact used.

The evidence of 16th century annals suggests that almost all Portuguese India fleets by-passed Brazil. From 1500, royal *regimentos* show a declining interest in Bahia as a way station to India and by 1565 ships en route to Goa were forbidden to winter in Brazil. For the first decade of the use of Bahia, Duarte Leite (1922) records only two instances of India fleets approaching the Brazilian coast, those of João da Nova and Tristão da Cunha. Marchant (1941) has noted records of only two ships calling at Bahia in the second decade, the *Piedade* (1517) and the *São Hieronimo* (1519). There appear to have been none in the third and fourth decades of the 16th century, until the *São Paulo* (1556, 1560) and the *Santa Maria da Barca* (1557).

These vessels and the two unspecified ships calling at Bahia in 1560 and 1566, suggest that a total of only eight ships linked Brazil and India in the critical 65 years before the beginning of the Spanish introductions by way of the Acapulco-Manila line. Nor did use of the Bahia route increase after 1565. Not more than a dozen ships followed the route between that date and 1730.

Persistent overemphasis by scholars on the use of the Bahia-Goa way would appear to hinge on Cabral's original assessment of the Brazilian landfall as a valuable way-station for India. Later fleets found the westward detour to Bahia too time consuming. Only five months separated favorable sailing conditions in the Atlantic from those in the Indian Ocean. Sailing from Lisbon in March or April, fleets had to make Mozambique by late August before the failing of the southwest monsoon cut them off from Goa. With a tight sailing schedule, Beseguiche (on the West African coast near the modern Dakar) proved a more practical restocking point (Marchant 1941: 455). Only when poor navigation, mechanical mishap or other extraordinary circumstance occurred was Bahia pressed into use and then only by individual ships rather than whole fleets.

Since only 20 ships appear to have used the Bahia-Goa route between 1500 and 1730 it is difficult to ascribe to it the important role in American plant introduction proposed by Merrill. Moreover, the paucity of ships before the opening of the other two post-Columbian trade routes — the Magellan or Cape Horn route (from 1521) and the Acapulco-Manila route (from 1565) — somewhat reduces the weight of Merrill's emphasis on the prior timing of the Portuguese route.

A fourth possible route for American economic plants and weeds might be the two-stage journey from the New World to Europe and thence to Asia. The presence of Iberian littoral species — for example, *Erythraea spicata* Pers. in Formosa (Merrill 1954: 229) — points to direct introductions from Iberia into Asia. Moreover, from 1496 to 1521 around 300 Portuguese ships sailed from Lisbon *direct* to Goa. Maize was being cultivated around

Coimbra in Portugal by about 1515, though whether it had originated from Brazil or via Spain from Mesoamerica is not clear. Plant interchange between Brazil and Portugal in the 16th century might well provide a less direct, but more reliable avenue to Asia for Brazilian cultigens and weeds than the little used Bahia-Goa route.

Leite, Duarte

1923 A exploração do litoral do Brasil na cartografia da primera década do século XVI. In *Historia de Colonização Portuguesa do Brasil*, edited by C. M. Dias, Vol. 2, pp. 391–440. Oporto.

Mangelsdorf, P. C. and D. L. Oliver

1951 Whence Came Maize to Asia? *Harvard University, Botanical Museum Leaflets*, Vol. 14, pp. 263–91. Cambridge.

Marchant, Alexander

1941 Colonial Brazil as a Way Station for the Portuguese India Fleets. *Geographical Review*, Vol. 31, pp. 454–65. New York.

Merrill, E. D.

1954 The Botany of Cook's Voyages and Its Unexpected Significance in Relation to Anthropology, Biogeography, and History. *Chronica Botanica*, Vol. 14, Nos. 5–6, pp. 161–384. Waltham.

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July, 1958

COMMENT ON THE SUPPOSED EVIDENCE FOR GOITER IN PRE-COLUMBIAN GUATEMALA

Abstract

Borhegyi and Scrimshaw's identification of goiter on two prehistoric pottery figurines from Guatemala is questioned and their discussion of iodine deficiency as the cause of endemic goiter is challenged.

IN A RECENT ISSUE of this journal, Borhegyi and Scrimshaw (1957) present photographs of two ceramic figurines that they claim indicate the presence of goiter in pre-Columbian Guatemala. The identification of the tumors represented on the figurines as goiters may be questioned. That in the effigy whistle shown in their Figure 1 *a*, *a'* seems rather low and is certainly small. The figurine fragment (Fig. 1 *b*, *b'*) shows a person with a greatly deformed face. The prominence on this individual's neck may be only part of a general deformity. In any event, as Borhegyi and Scrimshaw point out, these figurines "do not necessarily indicate that goiter was endemic in preconquest times since these might represent sporadic cases of a relatively infrequent condition."

Borhegyi and Scrimshaw quote Gage's report of goiter in Sacapulas in 1628 and state that it "went unnoticed in the medical literature." That is erroneous for Gage's description was quoted by Barton (1800), referred to by Hirsch (1883–86) in his classical handbook, and discussed by Greenwald (1945). It was neglected by Muñoz, Pérez, and Scrimshaw (1955a, 1955b). Carson (1951: 188–94) is given as the authority for the statement by Borhegyi and Scrimshaw: "It is known, however, that persons consuming significant quantities of marine food receive enough iodine to prevent the development of endemic goiter." There is nothing in Carson's book to support such a statement. The nearest to it is: "Now we ourselves could not exist without it [iodine] as a regulator of the basic metabolism of our bodies, through the thyroid gland which accumulates it." While this sentence by Carson is greatly simplified, it may be regarded as a satisfactory approximation to the truth. But, there is nothing in it about goiter. Moreover, the statement by Borhegyi and Scrimshaw is as erroneous as is the ascription. Goiter has been found to be endemic in many coastal areas, even among those living largely on marine products. In order to confine the discussion to the paper by Borhegyi and Scrimshaw, no reference is made to the voluminous literature on the presence of goiter in coastal regions, which those interested should have no difficulty in finding. That goiter is endemic in many coastal areas of Central America is evident from two of the papers cited by Borhegyi and Scrimshaw (Muñoz, Pérez, and Scrimshaw 1955a, especially 1955b).

Borhegyi and Scrimshaw conclude:

> It is possible that the settling of the Ladinos in the coastal areas after the conquest may have reduced the amount of iodine obtained from food of marine origin consumed by breaking up the traditional pattern of commercial exchange between Pacific-Atlantic coastal and highland Maya Indian groups.

They make no attempt to calculate how great such commercial exchange would need to be in order to supply the amount of iodine now believed necessary, nor how it would have been conducted without draft or pack animals. Nor do they attempt to explain why the availability of seafood does not protect the present-day inhabitants of the coastal areas of Guatemala, El Salvador, Nicaragua, and Panama, in all of which goiter is prevalent (Muñoz, Pérez, and Scrimshaw 1955b).

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Barton, B. S.

1800 *A Memoir Concerning the Disease of Goitre as it Prevails in Different Parts of North America*. Way and Groff, Philadelphia.

Borhegyi, S. F. and N. S. Scrimshaw

1957 Evidence for Pre-Columbian Goiter in Guatemala. *American Antiquity*, Vol. 23, No. 2, pp. 174–6. Salt Lake City.

Carson, R. L.

1951 *The Sea Around Us*. Oxford University Press, New York.

Greenwald, Isidor

1945 The Early History of Goiter in the Americas, in New Zealand, and in England. *Bulletin of the History of Medicine*, Vol. 17, No. 3, pp. 229–68. Baltimore.

Hirsch, August

1883–86 *Handbook of Geographical and Historical Pathology*. New Sydenham Society, London.

MUÑOZ, J. A., CARLOS PÉREZ, AND N. S. SCRIMSHAW

1955a Distribución geográfica del bocio endémico en Guatemala. *Revista del Colegio Médico de Guatemala*, Vol. 6, pp. 36–43. Guatemala.

1955b Endemic Goiter in Guatemala. *American Journal of Tropical Medicine and Hygiene*, Vol. 4, No. 6, pp. 963–9. Baltimore.

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NAVAJO AND ANGLO RECONSTRUCTION OF PREHISTORIC SITES IN SOUTHEASTERN UTAH

ABSTRACT

Examples of the rebuilding of a boulder structure by Navajo and of a cliff dwelling by uranium prospectors, both buildings in Pueblo III sites in the lower San Juan River drainage, illustrate the difficulty of establishing universally valid, diagnostic house types.

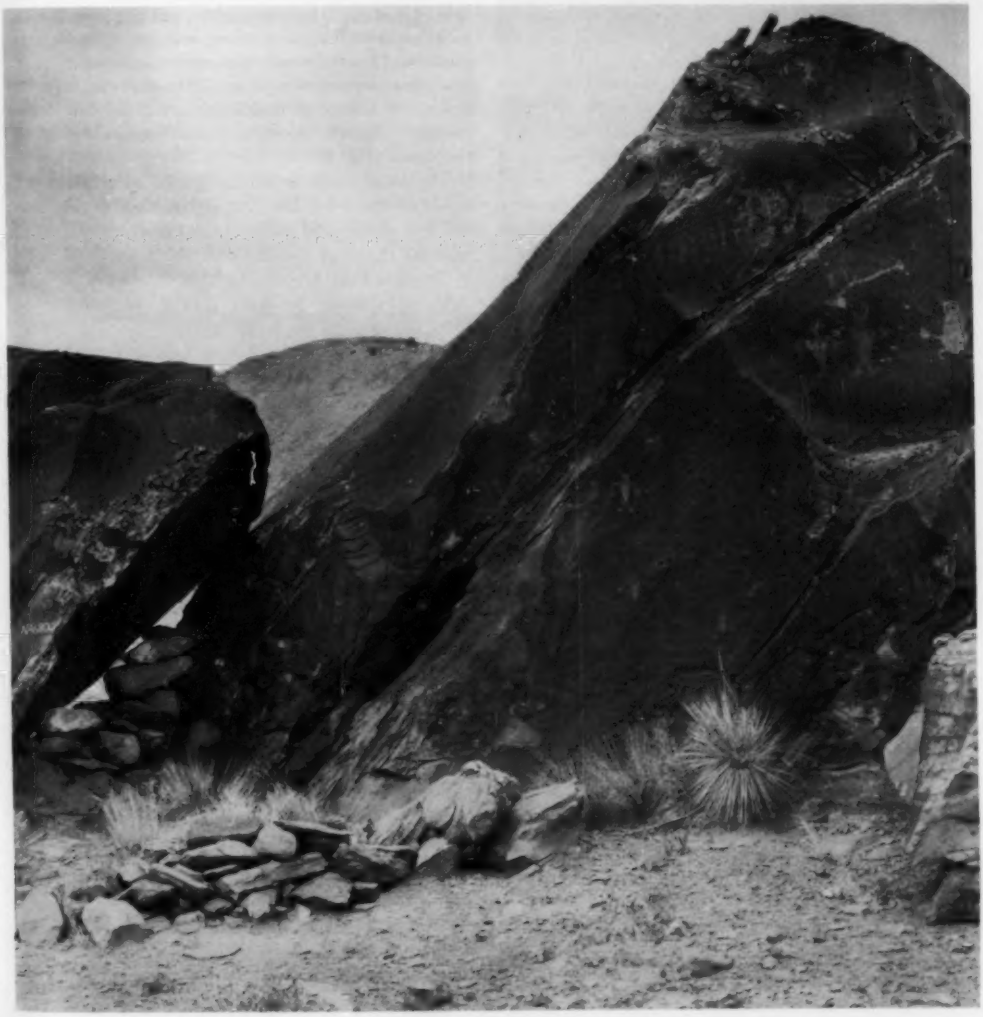

FIG. 1. Prehistoric boulder-type room at NA 6800. Note numerous petroglyphs. Considerable ceramic and lithic refuse was collected from the foreground area.

AS PART OF THE SALVAGE program in the Glen Canyon Reservoir basin, the Museum of Northern Arizona conducted archaeological surveys along the lower San Juan River, in Southeastern Utah, during parts of 1957 and 1958. Eighty-three Anasazi habitation sites were recorded by the surveys. On the basis of ceramic evidence, all of them appear to have been occupied during the late 12th and early 13th centuries of the Christian era. Sites located north of the San Juan River have consistently yielded large quantities of Mesa Verde pottery, while those south of the river are associated primarily or exclusively with Kayenta pottery wares. Regardless of ceramic affinity, all of the sites on the lower San Juan are small in size and primitive in structure. See Adams and Adams (1959) for a summary report of the lower San Juan survey.

The most common type of structure found on both sides of the lower San Juan is the so-called boulder site. These structures were built on soft sediments (in most cases the Chinle formation), utilizing large sandstone slump blocks for one wall and to some extent for the ceiling. Remains of boulder sites normally consist of a low, very coarse, masonry wall forming a semicircle and abutting against a slump boulder at either end. Most of the boulders thus utilized are somewhat overhanging, but not sufficiently so to protect the entire area enclosed within the adjoining wall. Masonry, even where protected from the elements, appears coarse and crude. It was apparently dry-laid, without spalls or mortar. The quantity of standing and fallen masonry seldom suggests a wall over 2 feet high. Consequently it is assumed that boulder sites originally involved some sort of lean-to construction of poles and brush, resting on a masonry foundation and leaning against the boulder at the top. The doorway is commonly in the center of the masonry wall. Figure 1 illustrates a characteristic room, in this case utilizing two boulders. Many boulder sites consist of no more than a single room structure; a few have as many as eight rooms. Rooms are almost never found adjoining one another, and as a general rule, each room utilizes a separate boulder. Considerable quantities of ceramic and lithic refuse are usually found in close association with rooms. Petroglyphs are another prominent feature of boulder sites, and are found immediately adjacent to, and sometimes apparently inside, the rooms (Fig. 1).

The most extensive boulder site encountered in the survey of the lower San Juan is NA 6800 (reported as Site 9 in Adams and Adams 1959, Fig. 4). It is situated near the mouth of Castle Creek, about one mile north of the San Juan River. The site consists of at least eight, and perhaps as many as a dozen boulder-type

Fig. 2. Boulder-type room at NA 6800 reconstructed and re-occupied by Navajos. Parts of the masonry foundation are visible in the left side of the doorway and to the right of the log structure.

rooms which are scattered over several acres, with well-defined agricultural terraces or plots intervening between them (Adams and Adams 1959: 16). Several hundred sherds were collected from the surface of this site. They have been analyzed by wares as: Mesa Verde white ware, 27%; Tusayan white ware, trace; Mesa Verde gray ware, 17%; Tusayan gray ware, 33%; Tsegi orange ware, 21%; and intrusive, post-abandonment Jeddito yellow pottery, 2%. Occupation of NA 6800 has been placed at about the end of the 12th century. In recent years a Navajo family from the Oljeto area has camped intermittently on lower Castle Creek. The Navajos have not only re-occupied the area of NA 6800; they have actually refurbished one of the prehistoric structures as their own dwelling (Fig. 2). The rebuilt house consists of a semi-circle of small logs resting on a low masonry foundation and leaning against a large boulder at the back. The whole is covered with brush and earth. For this reason the masonry foundation is not readily apparent in Figure 2; however, it can be seen inside the doorway and at the right of the structure. In most respects it is highly probable that the Navajos of today have produced a close replica of the Anasazi dwelling which occupied the same site seven centuries earlier.

FIG. 3. Navajo and prehistoric petroglyphs at NA 6800. Part of the foundation of a prehistoric boulder-type room is seen at the lower right.

FIG. 4. Prehistoric site (NA 6824) reconstructed and re-occupied by uranium prospectors. The walls in the foreground and at the extreme left, and the upper portion of the wall at the left rear, were built by prospectors.

It cannot be established for certain that the Navajo structure is actually built on a prehistoric foundation. The Navajos may have laid their own foundation, using the neighboring prehistoric remains as models. But at any rate, the Navajo dwelling is surrounded by Anasazi structures which have identical masonry and boulder. Moreover, the boulder utilized in the Navajo structure exhibits prehistoric petroglyphs. It is very probable, therefore, that at least the boulder, and probably also the masonry foundation, has been re-used. In addition to reconstructing a dwelling, the modern Navajo inhabitants of NA 6800 have added petroglyphs of their own to the considerable prehistoric gallery present at the site. One inscription states that the area is "Navajo Land" (Fig. 3). This assertion of sovereignty has no contemporary legal basis, since the San Juan River, one mile to the south, constitutes the northern boundary of the Navajo Reservation. Nevertheless Navajo summer grazing camps are found at several points along the north bank of the river. Other evidences of Navajo re-occupation at NA 6800 include a small, stone-walled corral and typical modern camp refuse, such as tin cans, bottles, and nails.

North and south of the San Juan, in the wooded mesas and plateaus that flank the river canyon, are found many other small sites contemporaneous with those on the river. Although exhibiting the same pottery wares and types, they differ markedly in structure. The mesa-top sites are in nearly all cases full masonry dwellings of the type normally associated with 12th century Anasazi settlement. It is thought that these structures represent more or less permanent residences, whereas the river canyon sites were no more than summer farming colonies.

Some 20 miles northeast of NA 6800, on upper Castle Creek, is a second example of modern re-occupation of a prehistoric ruin. The site in question (NA 6824) is a small masonry cliff dwelling which was first discovered by members of the Hole-in-the-Rock expedition in 1880, and is responsible for the name "Castle Creek." Miller (1959: 87, 98) gives the details of the discovery and a photograph of the ruin. In recent years it has served for several months as a domicile for prospectors. Length of occupation was determined from the dates of newspapers and periodicals found scattered in the site. The prospectors restored one or two prehistoric walls, and added several new ones as well as a flagstone floor (Fig. 4). The new masonry is similar in most respects to the old, but utilizes less mortar and no spalls. The appearance of the two is sufficiently similar so that NA 6824 looks from a distance like any other small and fairly well-preserved cliff dwelling.

The two isolated instances of re-occupation and reconstruction which have been described here do not, of course, exemplify any general pattern. They may, however, take their place beside the numerous known instances of Anasazi re-occupation of abandoned sites, for example at Aztec, Chaco, and Canyon de Chelly. All such phenomena have a certain instructive value in pointing up the difficulty of establishing universally valid, diagnostic house types, either Puebloan or non-Puebloan. The cases of re-occupation, on the contrary, suggest that the prehistoric Pueblo house, in whatever local form it occurred, was so well adapted to the needs and limitations of its immediate environment that successive occupants seven centuries later were hardly able to improve on it.

Acknowledgments. The photographs were taken by Christy G. Turner II, Museum of Northern Arizona Glen Canyon Project.

Adams, W. Y. and N. K. Adams
1959 An Inventory of Prehistoric Sites on the Lower San Juan River, Utah. *Museum of Northern Arizona, Bulletin* 31, *Glen Canyon Series*, No. 1. Flagstaff.

Miller, D. E.
1959 *Hole-in-the-Rock*. University of Utah Press, Salt Lake City.

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Museum of Northern Arizona
Flagstaff, Ariz.
September, 1958

NATIONAL SCIENCE FOUNDATION TRAVEL GRANTS

The National Science Foundation will award individual grants to defray partial travel expenses for a limited number of American scientists attending the Sixth International Congress of Anthropological and Ethnological Sciences, Paris, France, July 31–August 7, 1960. An attempt will be made to have the grants approximate round-trip air-tourist fare between the recipient's home institution and the location of the meeting.

Application blanks may be obtained from the National Science Foundation, Washington 25, D.C. *Completed application forms must be submitted by February 1, 1960.* Awards will be announced within two months after the closing date.

REVIEWS

Edited by Donald Collier

Migrations in New World Culture History. Edited by Raymond H. Thompson. University of Arizona Bulletin, Vol. 19, No. 2, Social Science Bulletin, No. 27. University of Arizona Press, Tucson, 1958. v+68 pp., 8 figs., 2 tables. $1.00.

This well-edited and attractively printed bulletin brings us the results of an interesting and successful symposium on migrations presented at the 1957 meetings of the American Anthropological Association in Chicago.

I choose my words advisedly when I describe the results as "interesting" and "successful." The whole problem of prehistoric migrations of peoples is one that can hardly fail to capture the interest and imagination of anthropologists as we pursue our basic scientific objective: to explain the similarities and differences in the patterns of culture in the world and the processes by which these patterns developed, and (eventually) to predict how these patterns will change in the future. Broadly speaking, similarities in patterns found in widely separated cultures can only be due to three possible processes: (1) functional adaptations to common ecological, social, or psychological problems, (2) diffusion, or (3) migration.

In much of the social anthropological research in recent decades there has been a tendency to emphasize functional adaptations, and to play down the importance of diffusion and migration in our explanations of cultural similarities. This emphasis was due in part to the reaction of structural-functional theorists to the Boas school — a reaction that was found in extreme form by the Radcliffe-Brown type of rejection of "conjectural history" — and in part to the hope that we would discover laws, or at least regularities, of cultural development in the responses of cultures to common situations in widely scattered areas of the world.

By now, it is clear (at least to me) that the most fruitful model to reach our basic objective is not a timeless structural-functional approach, nor a culture-area approach in which cultural developments through time in, say, Peru are compared with cultural developments through time in the Valley of Mexico. Rather, I think the basic outlines of a more fruitful model are beginning to emerge in a combination of what Eggan has called "the method of controlled comparison" and in what Romney has described as "the genetic model." In this approach one selects a genetically related series of cultures for comparative treatment on which there is a good possibility of controlling the geographical and historical frames in which the cultures have developed over time. With good linguistic data it is possible to reconstruct the proto-language and to locate the dispersal area with some precision, and to estimate with lexicostatistics how much time has been involved to reach the present distribution. It is probable that the proto-kinship system can also be reconstructed for most groups. How far beyond this we can go, say, in subsistence and in religious systems, is not yet clear. At any rate, with the proto-language, the proto-kinship system, and the point of dispersal described reconstructively, the stage is already reached where one can feed archaeological and physical anthropological data into the model and thereby generate a whole series of researchable hypotheses that will more sensibly guide research into critical areas in all branches of anthropology.

To take a concrete example of a genetically related series of cultures in North America on which controlled comparisons are beginning to pay off, we have the Athabascan case. We can now infer with some precision that the Na-Dene ancestors of the Athabascans were one of the last Amerindian groups to enter North America from Asia; that the point of dispersal for the now widely dispersed Athabascans was Northwestern Canada or Alaska; that the Pacific Coast Athabascans and the Apacheans of the Southwest are off-shoots by migration from the Northern Athabascan block; that the Apacheans split off 700 to 900 years ago and migrated to the Southwest where they began to differentiate into the present seven tribal groups by a combination of functional adaptations to varying ecological settings and differential diffusions from the Pueblos: that this process of differentiation continued in Postconquest times as the cultures were subjected to Spanish and Anglo-American influences in variable ways.

With the geographical and historical frames under reasonable control and with good data on the proto-language and proto-kinship, we are now in position to make maximally fruitful use of archaeological and physical anthropological data as they come in. For example, can the southern migration and the gradual differentiation of the Apacheans be linked to archaeological manifestations and tracked over time? To what extent have Athabascans maintained uniformities in physical type, and to what extent have they been modified either by selective adaptations to different environments or by intermarriage with Pueblos and other tribes? We are now also in a better position to make fine-grained, structural-functional analyses and comparisons of Athabascan tribes.

Given this genetic model as a basic approach, it is clear that *migration*, as tribes disperse from the point of dispersal on the proto-time-level, is a crucial process for us to understand. Furthermore, the solution of problems of migrations requires concepts, methods, and data from all the branches of anthropology, and this is why I think the results of the symposium were successful. There are archaeological papers by Haury on "Evidence at Point of Pines for a Prehistoric Migration from Northern Arizona" and by Meggers and Evans on "Archaeological Evidence of a Prehistoric Migration from the Rio Napo to the

Mouth of the Amazon"; an ethnological paper by Dozier on "Ethnological Clues for the Sources of Rio Grande Population"; a physical anthropological paper by Marshall Newman on "A Trial Formulation Presenting Evidence from Physical Anthropology for Migrations from Mexico to South America"; and a linguistic paper by Voegelin on "The Dispersal Factor in Migration and immigrations of American Indians." For each paper there was a discussant, and these comments by Reed, Collier, White, Hulse, and Hoijer are both astute and constructively critical. A final paper by Rouse on "The Inference of Migrations from Anthropological Evidence" provides a sharply focused appraisal of the contributions.

I agree with Reed and Rouse that Haury makes a very convincing case for his migration from the Kayenta-Hopi region to Point of Pines in A.D. 1280–85. For the general anthropological reader a more extended discussion of the possible relation of this migration to drought conditions would have added to the paper. The Meggers and Evans paper has, I would guess, great significance for future research if one considers Greenberg's still unpublished tentative linguistic classification of South America. Greenberg groups the Tupi and Arawak Equitorial languages with the Andean languages in a manner that suggests to me we may eventually find more evidence of wide-ranging migrations out of either the Andes (or the neighboring Montaña as Collier postulates) into the lowlands of Eastern South America. If this linguistic classification holds up, it leads to the hypothesis that the area of dispersal for the Andean-Equitorial block was somewhere in the Andean region with both the Arawak and Tupi peoples streaming eastward to come into variable types of contact with the Ge-Pano-Carib peoples.

Despite White's sharp criticisms of specific points, Dozier's paper clearly represents an important attempt to use ethnological evidence for tracing migrations, and it raises questions that we should eventually be able to solve by a close linkage of ethnological and archaeological data. Newman's contribution presented both data and a method of approach that were new and refreshing to me, even though, as Hulse points out, the data can be interpreted in alternative ways. Voegelin's paper is important not only for its methodological suggestions and pronouncements, but also because it contains a revision of his earlier estimates on the relative chronology of New World immigration.

Nearly all the papers indicate that we have reached the stage when mere postulation of prehistoric migrations is an outmoded intellectual exercise. We can now use hard data and new methods to home in on some actual cases. I hope this bulletin will be widely read by all branches of our profession.

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Trend and Tradition in the Prehistory of the Eastern United States. Joseph R. Caldwell. Memoirs of the American Anthropological Association, No. 88, and Scientific Papers, Vol. 10, Illinois State Museum. Menasha and Springfield, 1958. xiv+88 pp., 14 figs., appendix. $1.50.

Some of the major "how" and "why" problems of eastern North American prehistory are clearly stated in this monograph. Well stated too are a series of methods and techniques capable of producing answers from the kinds of data potentially available. Caldwell asks if there are significant differences in development between the East and regions of nuclear civilization, and suggests that if there are, we may be able to find some of the historical processes which have given the East this special character. He is also concerned with the nature of connections which were established with Mesoamerica. In attempting to understand the processes, three successive trends are visualized. These are development of efficiency in exploiting the forest habitat from the earliest occupation of the East to the Middle Woodland period; a trend toward regional differentiation which increases in strength through most of the rest of the prehistoric period; and "a progressive drawing together with the nuclear American civilization (p. ix)."

In his effort to comprehend the tremendously variable culture history of this vast area Caldwell works with concepts of pattern and tradition, defined as follows:

> These special regularities are called patterns. We use this term in the widest sense. It is to include any perceived regular distribution of formal similarities or recurrent associations with a particular range in time or space or both. It can also include any distinguishable trend or distinguishable rate of change (p. 2).
>
> The concept of tradition, . . . is in the present view another specific kind of pattern. In a general sense, any culturally transmitted pattern of action seen through time is a tradition, . . . a culture-historical tradition as a main-line, areally based continuity of what would theoretically be a culture whole. . . . What is always true of the tradition as we here consider it, . . . is that its space-time limits mark the effective contrast with neighboring traditions (p. 3).

I quote extensively here in order to point out that these two definitions are so broad as to permit almost anything archaeologically recognizable, from a ceramic mode to a whole culture, to be used with equal weight in the study of historical trends. It leads, I am afraid, to some loss of communication because the reader and Caldwell may not always have the same thing in mind when one of the many confusing terms in Eastern archaeology is used. But certainly the concepts Caldwell uses do embody a clear recognition, sometimes overlooked by the mechanical manipulators among archaeologists, that culture has time and space dimensions simultaneously, and that both may be traced through the study of style changes in anything perceptible.

I feel that the program envisioned is admirable. Unfortunately, its execution is disappointing. Specifically, the basic space-time referents for the Middle Eastern, Gulf, and South Appalachian traditions, the latter two providing the framework for the entire study, depend very heavily on unpublished or inadequately published materials controlled only by Caldwell. They are not

available for evaluation, independent interpretation and synthesis, or anything else, by the reader. To compound the difficulties further, this popularly styled, if terminologically obscure, account of developments in trends and traditions which comprises the bulk of the work is a steady succession of flat statements of opinion, often undocumented or incompletely documented. Some relevant literature is ignored in both fact and theory, and some points of view are, I feel, misrepresented.

Even more unfortunately, apparently in the spirit of "We are far less concerned with what the Gulf tradition is, . . . , than with what the Gulf tradition does in relation to the other traditions we formulate (p. 1)," definitions, or even simple descriptions of traditions and complexes, are missing or obscure excepting for a reference to the 1955 formulations of Willey and Phillips. Although I am apparently held responsible for the Gulf Tradition (p. 3), some of Caldwell's usages do not fit the tradition as I know it. An obvious question is how one knows what something does until he knows what it is?

Space limits specific reference to only a few examples of undocumented assertion. I will restrict myself to the sections on the Gulf and South Appalachian traditions, which are basic to Caldwell's synthesis and which I know best. To avoid using this review as a platform for my own views on the archaeology of this area, a practice which I believe to be improper since there is not space for documentation in a review, I will omit references to areas of disagreement in interpretation between Caldwell and myself, and will limit myself to fact or lack of it.

A flat statement that Mossy Oak is the earliest South Appalachian manifestation (p. 15) is of interest in this connection, as is one that Swift Creek overlaps with it in time (pp. 35–6). A reference to Swift-Creek-style pottery in northern Hopewellian sites (p. 37) needs documentation too. Late Swift Creek in Central Georgia is dated by the occurrence of what is stated to be an "early" variety of Swift Creek in the as yet undescribed Forsyth focus(p. 37), which leads in turn to the assertion that the Napier focus follows late Swift Creek (p. 44). However, Caldwell notes that Napier pottery occurs with middle to late Swift Creek at Kolomoki (p. 58) and in the as yet undescribed Tugalo site (p. 47).

A long discussion of the Etowah culture omits description of either the Etowah or the Wilbanks compexes. Some ceramic styles are illustrated, but the discussions and interpretations offered need more than this if the intent is understanding rather than blind acceptance of an arrangement of terms.

Figures 7–12, which Caldwell does note are incomplete, illustrate the basic ceramic types and complexes upon which the entire synthesis depends. In most cases, it is only through them that a person not thoroughly familiar with the materials could follow the discussion. Yet these, in addition to being the only sources for otherwise undescribed complexes in many cases, are incomplete and misleading too. I might, for example, question the placement of Early Swift Creek in central Georgia some three or four centuries before the same pottery type in northwest Florida, although the two pots of the type illustrated for the latter area are mislabeled Santa Rosa complex. This term, if anything, usually refers to the rocker-stamped, incised, and punctated component of the Santa Rosa–Swift Creek complex. In Figure 10 the pot representing the type, Kolomoki Complicated Stamped, has a distinctly unusual form, although C. B. Moore and I have illustrated many examples. Oddly, the vessel labeled Late Swift Creek is rather good Kolomoki in total shape and rim treatment, and includes a stamp design used on a vessel of the type excavated in Mound E at Kolomoki. A vessel labeled "Early Woodstock" has a design duplicated on another specimen labeled "Napier," which is very similar to some common Kolomoki designs and has a classic Kolomoki rim treatment.

In Figures 11 and 12 I would classify the "Savannah" pot as Wilbanks Complicated Stamp. Early Lamar is unknown, and the Cherokee complex lacks the complicated stamping that is its major decorative style in the 16th and 17th centuries.

Under the Gulf tradition we find a statement, supported by an unspecified reference to the work of Goggin, that the historic eastern Timucua show more Gulf and less Mississippian characteristics (p. 53). Since historic pottery in the appropriate area is check or complicated stamped and plain, I fail to see the Gulf elements. That there are Gulf elements in the religious and social structures may be true, but demonstration and explanation are needed.

The references to stratigraphy at Kolomoki (p. 56) do not point out that the "stratigraphy" referred to is that of placement of a deposit of specialized ceremonial ware over the remains of a midden. Obviously, this is a special kind of stratigraphy with special significance, not comparable at all to succession of midden layers. I was also fascinated to learn that there is gradual change in the Kolomoki period (p. 57). This is true, I am sure, but I would like a reference, or a description, telling me what change, and where. I do not know either of any "relatively pure" Kolomoki mounds excavated by C. B. Moore (p. 57). My own studies, including analysis of all of the available Moore collections, indicate that in burial mounds the Kolomoki Stamped vessels are accompanied by the incised, painted, and perforated ware, often in effigy forms and often with pedestals. All of these are classifiable as Weeden Island types in normal typology based on the decorative styles.

A final point, so that we will not by-pass completely the often abused Mississippian tradition, is that the earliest complex at the Roods Landing site, according to Caldwell's inadequate popular description (1955) is characterized by sherds that are either Moundville Incised or are a grit-tempered copy of this type. Since the type is a late Mississippi marker from the Tennessee-Cumberland to the mouth of the Alabama River, the Roods Landing manifestation can hardly be early Mississippian in the sense of the Hiwassee Island, Macon Plateau, and other complexes to which it is compared.

I admire the clear visualization of major problems, the methods outlined, and the entire theoretical approach in this study, all certainly to be emulated. Regrettably, the main part of the monograph can only be recommended as a summary statement of Caldwell's personal opinion of what might have happened in Eastern prehistory. Any contribution toward the solution of the problems outlined must be evaluated accordingly. As a qualified archaeologist, Caldwell's opinions deserve respect, but as far as this monograph is concerned they remain opinions. *Trend and Tradition in the Prehistory of Eastern United States* is not presented as the speculation that much of it must be until the facts are available and the references are complete, but rather, is styled as an authoritative statement.

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The Chronological Position of the Hopewellian Culture in the Eastern United States. James B. Griffin. Anthropological Papers, Museum of Anthropology, University of Michigan, No. 12, Ann Arbor, 1958. i+27 pp., 2 figs. $1.00.

This paper is timely and significant, dealing as it does with the temporal placing of one of the most important prehistoric culture complexes in North America. A measure of chronological control is now possible through the medium of radiocarbon dating, although paradoxically, Ohio Hopewell proper has not been adequately described or defined, nor do we have a substanial series of dates for this climax material.

In the paper at hand Griffin assesses all of the pertinent radiocarbon dates (from four different laboratories), beginning with those of the Adena complex of the central Ohio Valley. Adena is important in this context because there is abundant cultural, and now chronological, evidence that it was in part ancestral to the Hopewellian development. Some 14 dates are available for Adena ranging from 830 B.C.±410 to A.D. 782±150. Seven of these dates are from the *recently* excavated Toepfner Mound, near Columbus, Ohio. Except for the 830 B.C. date these assays cluster neatly between 460 B.C. and 250 B.C. The recency of excavation is emphasized here because a number of the Adena-Hopewell dates are from materials excavated years ago and have been gathering dust and contamination (?) in museums for some time. While the author is careful to specify the nature of the material dated in most instances that specific dates are mentioned, we are not told which is relatively fresh material and which was excavated some time ago. Needless to say, a report of this nature should obviate the necessity of referring to the original lists of dates. Griffin's conclusions that Adena did not persist after about A.D. 200–300 and that it probably began before 830 B.C. are well-taken.

Of the four dates available for Ohio Hopewell, three are from materials excavated by Moorehead in 1892 from the type site on the Hopewell farm, Ross County, Ohio. One sample (shell) gives a reading of 335 B.C.±210, whereas the other two dates come out as 94 B.C.±250 and 1 B.C.±200. The fourth date, from a disturbed mound believed to be Hopewell, is placed in the first century of the Christian era. Even though none of these samples is fully satisfactory, it is perhaps no coincidence that three of them cluster within some 150 years of each other. Shell is unreliable for dating, and it remains to be seen whether or not the earlier date will stand.

There are indications of Hopewellian relationships to the north and east of the southern Ohio climax area, and a feeling is growing that the Hopewell complex may in part have derived from that region. Griffin considers a number of dates from western Pennsylvania, New York, and Ontario. Much of the material of suggested Hopewell affiliation does in fact date earlier than Ohio Hopewell, but a great deal more field work and study is needed before these relationships become clear.

Perhaps the best controlled information on a Hopewellian complex is from southern Illinois. Here a rather impressive series of excavations has been undertaken, including (unlike Ohio) both occupation and burial sites. A relative chronology based upon pottery analysis is divided into an Early, Middle, and Late Hopewell sequence for the region. This sequence is said to be substantially confirmed in the series of 19 radiocarbon dates presented by Griffin. The author designates the components which he believes are Early, but has no dates for them. There are two dates for Havana Mound 9, 386 B.C.±256 and 250 B.C.±250, which are good dates for early Illinois Hopewell, although Griffin states that the associated material is typologically Middle Hopewell. For material designated as Middle Hopewell, with dates to fit, we have a range of 50 B.C. to A.D. 20 in a series four dates. Late Illinois Hopewell falls within the period of about A.D. 210 to 425. Thus there is some reason to believe that when unequivocal Early Illinois Hopewell (and Ohio) dates are available, they will fall between 500 B.C. and A.D. 1. On the basis of these dates and those from Ohio Griffin suggests that "Hopewellian in the north" flourished from about 400 B.C. to A.D. 400 (p. 1). It might be well to point out here that not a little of the difficulty in interpreting these dates is due to the wide variability of the early Chicago assays by the carbon black method.

A series of dates from northeastern Iowa, southwestern Wisconsin, and southern Minnesota are discussed because they are associated with purported Hopewellian materials. Even though these particular finds are not Hopewellian in Griffin's (and my) opinion, he takes the opportunity to state that material of valid Hopewellian affiliation from that area shows strong similarity to Middle Illinios Hopewell.

Another enclave of this nature has been known for some time from central and western Missouri. The Hopewellian affiliations here are attenuated, but nevertheless influence from Illinois may be reasonably postulated. A series of four dates span the period from A.D. 8 to 680. Griffin believes that the material should date from about the middle of this range. His brief discussion of central

Plains prehistory of this general period contains a number of stimulating ideas.

The last region considered is the Lower Mississippi Valley, where there are strong but perplexing Hopewellian affiliations. Antecedent to, or perhaps early in the era of Hopewell influence from the north, is the Tchefuncte phase, which is dated, mostly from shell, with an unbelievably long range. Two dates averaging 260 B.C., fit the estimates of the excavators, with whom Griffin and I concur. Tchefuncte is probably preceded in the area by the Poverty Point phase which is convincingly dated from about 900 to 400 B.C. This would make it contemporaneous with Adena in the north. Griffin reasonably points out that because of the time differential certain features of Poverty Point could hardly have derived from northern Hopewell, as had been suggested by the excavator, Ford. My own feeling is that Poverty Point has closest affiliation with Adena. In answer to Griffin's statement that there are "no earthworks in the Ohio Valley that resemble at all closely those at the Poverty Point site" (p. 24), one might point out that large earthworks and conical mounds are important features shared by both Poverty Point and Adena.

These questions emphasize the fact that much remains to be understood about Poverty Point. The post-Tchefuncte phase in the lower Mississippi Valley is known as Marksville, and it has a high degree of similarity to Hopewellian in the north. The question is, which Hopewellian? Griffin, referring to the Lower Mississippi in general, states that the closest connections are with Illinois area (p. 24). While I do not deny any of the Illinoian relationships, I see influence from Ohio as well. The Marksville site, for example, has an earth embankment and at least one conical mound. In this sense Griffin is inconsistent for (in connection with Poverty Point) he states that there are few if any earth works in Illinois comparable to those in Ohio. It is to be hoped that this will become clearer when we obtain some dates for Marksville.

Hopewellian influence persists, however, into the succeeding Troyville-Issaquena phases, which are fairly well dated through a series of at least 11 dates. Griffin would place Troyville and Issaquena between A.D. 500 and 900. On the basis of four well-clustered dates from three sites I would place the Issaquena phase at about A.D. 500 to 700, with late Troyville persisting perhaps to A.D. 900. At any rate, about A.D. 500 would be a terminal date for the antecedent Marksville phase, which probably developed some 200 to 300 years earlier.

Griffin is puzzled by the significantly later dates for materials in the Lower Mississippi Valley that are comparable to those in Illinois and Ohio. For example, there are fairly specific similarities in Issaquena pottery to that in Middle Illinois Hopewell, yet they date at least 250 years apart. Obviously, a good many more data are needed.

Griffin's paper constitutes a fair summary of the chronological aspects of the Hopewellian problem and it points up many problems that remain to be worked out. But before much further progress can be made, we need a definitive study of Ohio Hopewell proper, including analysis of occupation sites as well as mortuary mounds. While Adena relationships are fairly clear, we need to know much more about connections to the northeast. Another major series of problems is to be found in the relationships between Ohio Hopewell and that in Illinois, and between the former and Hopewell in Lower Mississippi Valley.

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Geology of the Great Lakes. JACK L. HOUGH. University of Illinois Press, Urbana, 1958. xviii+313 pp., 79 figs., 22 tables. $8.50.

Part I, slightly less than half the book, depicts the modern lakes, geology of the basins, bottom topographies, level fluctuations, lake currents, temperature characteristics and overturns, chemistry of the waters, bedrock history, glacial history, and methods of dating.

Part II introduces the history of the Great Lakes, recounts nature of evidence, beaches, deltas, and such, and discusses the postglacial uplift which has so altered the level of many features involved. Discussion of lake history ensues, for Erie and Huron, Lake Michigan, Superior, and Ontario basins, in separate chapters on each. For Algonquin and later lake stages, the histories of all basins involved are treated together, properly enough, in four chapters, on Lake Algonquin, post-Algonquin low stages, Nipissing Great Lakes, and transition from Nipissing to present. Though fewer stage names appear in these chapters, about as many pages are apportioned to them as to the total of all preceding stages in the several separate basins; and for good reason. This is the part of lakes history most radically revised since Leverett and Taylor's 1915 work (*U. S. Geological Survey, Monograph* 53); it was the time when nature was altering levels most radically, a time of low draining and of great uplift; also, it is this nearer approach to the present that most concerns archaeology and the distributions of lacustrine faunas.

The final chapter on radiocarbon chronology of Great Lakes history brings together available datings in the lake sequence, and is a fine reference for interested persons. It is to be hoped that this list will be much amplified during the coming decade, with more unequivocal material associated with the Algonquin beach, and for other stages. Seventy-five good illustrations are included. A coordinated series of 23 maps depicts the changing panorama of lake size, discharge, ice front, and so forth, and is probably the most extensive published set on the glacial Great Lakes.

A number of the innovations in Great Lakes history are the author's own. He has an observant eye for certain lacks (such as Nipissing beaches in southern Lake Huron), and relevant facts (Dreimanis's radiocarbon dates on site materials) and logic (no water, no downcutting) for dealing with them. And so the Nipissing

and Algonquin levels are the same in southern Lake Huron. To me this looks well established.

Another novel interpretation is northward drainage from Erie to Huron basin during Grassmere, Lundy, and incipient Algonquin stages, and to an escape from Huron basin north, west, and southwest, via Mullet, Burt, Charlevoix, and Torch lakes, to Glacial Lake Chicago. A conclusion of Hough's to which I entirely subscribe is that ice border during Algonquin beach stage was close to, and but little north of Sault Ste. Marie, Ontario. However, his interpretation that the principal stage of Lake Algonquin was initiated by glacier advance closing the Kirkfield outlet, and was terminated by recession of ice reopening the same, after which the upper group beaches formed during downcutting of this outlet, militates against the following. The Algonquin beach has been traced into the Kirkfield–Fenelon Falls outlet at an elevation of 30–40 feet above outlet floor. This depth of water seems appropriate for a river that was as large as or perhaps larger than the present Port Huron drainway, as Taylor judged from examination of the outlet. But it seems nearly impossible that the Kirkfield outlet could accommodate the discharge of the same water body after it had dropped 40 feet in level below the Algonquin beach, as postulated by Hough's interpretation of the "upper group" beaches. Another item conflicting with this interpretation is Taylor's statement, subscribed to by R. E. Deane, that the "upper group of Algonquin beaches" converge down the tilt-line. This particular convergence is not well demonstrated, either by Taylor or by Deane, but without more factual evidence, my impression (based on many field inspections) supports Taylor's.

Hough's correlation of Niagara cutting of St. David's gorge with the Two Creeks low water stage, and the drift filling of this gorge during Valders re-advance is interesting. Likewise is his inserting the Two Creeks low between earlier (upper) Lake Warren stages, and a later (lowest) Warren; he has the Wayne beach formed after "upper Warren," and after the Two Creeks low interval, but before the main "lowest Warren," which was a higher level than Lake Wayne. Leverett and Taylor simply had Lake Wayne preceding the higher Lake Warren. Later studies on river terraces by James W. Bay indicated a lake of Lake Wayne level, following Lake Warren. I suggest that contact with Bay's conclusions might modify, and even fortify, some of Hough's ideas on this.

In line with his reinterpretation of the Nipissing beach in southern Lake Huron and in order to explain why the downcutting caused by the southern outflow did not occur until after Nipissing beach time, Hough proposes that the Port Huron discharge did not reach a maximum until then and *denies any drainage from Lake Superior basin to the Port Huron outlet until Nipissing time.* Existing knowledge suggests otherwise. Leverett's strong beach (elevation 1000–1020 at south edge of Houghton Quadrangle) on Keweenaw Peninsula, 200 feet below and parallel to the Lake Duluth beach, appears likely to associate with Lake Algonquin in time and in ultimate drainage course, even though it may not be Algonquin, as Leverett thought. Hough (p. 190) recognizes that this beach is too low to have connected with the St. Croix outlet (elevation 1017), which has been postglacially uplifted less than Houghton Quadrangle (by at least 100 feet). Also he has made a good case for the ice front in Lake Superior basin blocking the Au Train–Whitefish lowland during most of, possibly not all, Algonquin beach time. Until the Au Train–Whitefish passageway from Lake Superior to Lake Michigan basin is shown *by former water levels* to postdate the Algonquin beach, and until the "upper group" (Algonquin) beaches are demonstrably dissociated from the Port Huron outlet, the evidence is against the author's italicised conclusion above.

To rationalize the Algoma stage of the Great Lakes, Hough has ingeniously provided logical reasons for a temporary static level during the time of post-Nipissing uplift. There is good evidence on South Fox Island for believing the Algoma to have been a resurgent rather than a static water level, and it is alluded to briefly in R. T. Hatt's "Island Life in Lake Michigan." What caused the resurgence is enigmatic. It would require strong evidence to compel the repugnant conclusion of a temporary reversal in uplift for the northern lakes; and as Hough points out, this would not explain an Algoma beach in southern Lake Huron anyway. Perhaps it is worth examining whether, at this stage in post-Nipissing uplift, and because of uptilting, some large drainage became turned toward Lake Superior or northern Lake Huron, from a prior northward or northeastward course; and that this raised levels of the post-Nipissing lakes temporarily and formed the Algoma beach before the rise was mitigated by outlet deepening and continued uplift.

Perhaps this is a good place for me to acknowledge debt to Hough for his bottom coring of Lake Michigan and for bringing up so agreeable a substantiation of the "post-Algonquin low stages."

The reader should be aware that the book brings up to date a complicated story, but that there is still much of the Leverett and Taylor monograph that is not "outdated" by it. It is best in presentation of revisions based on abundant new field data, but undoubtedly introduces some errors of its own in proposing revisions induced or deduced without enough new facts from the field. In illustrations it is far superior to the previous work, and it seems to be more keenly analytical, but in very few spots does it convey an equivalent, ringing familiarity with things on the ground. The reader may enjoy, as I did, the jolt of seeing Great Lakes precipitation tabulated in "cubic feet per second," with his own reminiscence of certain days when the Heavens burst. Viewing reflection from my own conscience, I admire this contribution which modernizes Great Lakes history, and highly value my copy of the book.

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I assume that most archaeologists dealing with the Great Lakes regions are already familiar with the work of Jack L. Hough. His new book, "Geology of the Great Lakes," is an excellent tool for the researcher interested in glacial and post-glacial geochronology and opportunities to relate archaeological manifestations to geological events.

My interest in this subject was stimulated many years ago by George M. Stanley, first as his student and later, in 1939, as his assistant on a survey of raised beaches and marine limits along the east coast of Hudson's Bay. While stormbound on rocky islands, traveling by canoe, or walking inland over the succession of old strand lines, Stanley pointed out the possible interrelations of glacial geology and archaeology. Some 15 years later I began to understand what he was talking about and used this approach in Upper Great Lakes studies.

My postscript to Stanley's review of Hough's book is intended as an appraisal of its utility for archaeologists. It is part two of Hough's book, a detailed history of the lake stages and the radiocarbon chronology, that will be most useful to the archaeologist. But the archaeologist must read the book carefully so that he separates clearly the well established events and correlations from those upon which well qualified opinion is still divided.

It seems to me that the geological events and geochronology of the Lake Michigan basin are best known. The sequence of events in the Lake Huron basin is also well known, but the correlations between it and the Lake Michigan basin in the stages prior to glacial Lake Algonquin are still uncertain. Even more uncertain are the correlations between the Upper Great Lakes and the Lower Great Lakes. Within the Upper Great Lakes the basin of Lake Superior requires some additional geological studies, particularly of the post-Lake Duluth stages. Nonetheless, I know of no other place in North America where there is such a succession of late glacial and post-glacial events encompassed in a span of about 15,000 years. In the Upper Great Lakes, especially, the orderly stratified successions of moraines, fossil beaches, old lake beds, and extinct channels mapped and interpreted by glacial geologists are of great use to archaeologists at present and will become more so as refinements are made and intra-basin correlations demonstrated.

The radiocarbon chronology is best for the Michigan and Huron basins. But until many more dates, both geological and archaeological, are available there is still room for differences of opinion on absolute chronology. Hough, for instance, places the Nipissing stage (605 feet above present sea level) at about 2000 to 1000 B.C. Yet, as Hough indicates, the levels in the Michigan and Huron basins had risen at least 350 feet to a level of at least 580 feet above present sea level by about 2925 B.C. (Y–238) and 2692 B.C. (S–24). From an archaeological point of view I would consider the Nipissing stage to begin shortly after 3000 B.C. and last until shortly before 1000 B.C. In a similar way one could rearrange slightly the chronology of stages between the end of the Two Creeks interstadial, which is very well fixed by radiocarbon dates, and the beginning of the Nipissing stage. With the exception of one archaeological date that might indicate the age of the Sheguiandah stage, all of these items have been presented by Hough.

My comments are in no way intended to be critical. Hough's book is the best there is on this subject and I am very dependent upon it. But to use the book to its best advantage the archaeologist must become thoroughly conversant with its contents, understand the alternate interpretations, and even become able to provide his own interpretations, if need be.

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The Bolen Bluff Site on Paynes Prairie, Florida. Ripley P. Bullen. Contributions of the Florida State Museum, Social Sciences, No. 4, Universtiy of Florida, Gainesville, 1958. 38 pp., 5 tables, 10 plates. $.75.

This publication is an important contribution to Southeastern archaeology. It presents new data and synthesizes present knowledge on the projectile point types of the preceramic periods of central Florida. The new projectile point types which have been defined by Bullen are named the Bolen and Arrendondo. If they withstand the test of scientific examination they will prove quite valuable in Southeastern archaeology. While both, at present, are placed in a generalized Early Preceramic temporal position, Bullen feels that further information may allow the Early Preceramic to be divided into two phases, one characterized by the Bolen point and the other the Arrendondo.

Suwannee points had given us previously a time marker for the beginning of a definite Florida culture sequence. Prior to Bullen's work at Payne's Prairie, the next generally recognizable marker was Orange Plain pottery. This left us with a gap of some 7000 years, from 9000 to 2000 B.C., for which we had no artifacts that could serve to identify intervening temporal positions. The Bolen and Arrendondo points, assigned by Bullen to the period from 7000 to 5000 B.C., divide this gap in the middle.

The above dates appear for the first time in this publication in a table on the culture sequences of northern and central Florida. These and the other dates in the table are based on the series of radiocarbon dates previously published by Bullen (*Florida Anthropologist*, 9:31–36, 1956; 11:97–110, 1958). Although radiocarbon dates have not been obtained for all of the periods named, Bullen has achieved a convincing absolute chronology by fitting the available dates into the previously accepted Florida sequences.

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Report of the Investigation of the Spotted Bear Site, 39HU26, and the Cottonwood Site, 39HU43, Hughes County, South Dakota, 1953. Wesley R. Hurt, Jr. Archaeological Studies, Circular No. 6, South Dakota Archaeological Commission, Pierre, 1954. iv+36 pp., 27 figs., 3 charts. $.75.

Report of the Investigation of the Swan Creek Site, 39WW7, Walworth County, South Dakota, 1954–1956. Wesley R. Hurt, Jr. Archaeological Studies, Circular No. 7, South Dakota Archaeological Commission, Pierre, 1957. iv+52 pp., 27 figs., 10 charts. $.75.

The excavations reported in these monographs were carried out under the auspices of the W. H. Over Museum of the State University of South Dakota, the South Dakota Archaeological Commission, and the National Park Service as contributions to the Inter-Agency Archeological Salvage Program in South Dakota. The Spotted Bear and Cottonwood sites, located ¼-mile apart on the left bank of the Missouri River about 10 miles airline northwest of Pierre, have now been erased by rising waters of the Oahe Reservoir. The Swan Creek village and cemetery and two small nearby sites, dealt with in the second monograph, are situated on the left side of the Missouri approximately 60 miles in an airline to the north-northwest. These sites will be inundated by the huge Oahe pool within the next few years.

The Spotted Bear site was an unfortified village of subcircular, semisubterranean earth lodges, cistern-like cache pits, borrow pits, and refuse deposits which yielded bison and other faunal remains; artifacts of trade metal, stone, bone, antler, and shell; and almost 8000 pottery fragments. Body sherds are chiefly simple stamped or plain, and most of the rim sherds are classified as Talking Crow and Stanley types (some of the latter are identified as Le Beau types in the second report).

The Cottonwood site consisted of scattered cache or refuse pits and circular floors of impermanent dwellings, possibly skin tipis, containing an infant burial and trade objects of glass and metal, which were superimposed on pits and middens producing pottery sherds, bone and stone artifacts, and charred animal bones. Documentary evidence and identifiable cartridge cases of copper and brass derived from the upper level indicate that the later component was a Dakota community of the 1870's which was contemporaneous, in part, with the Riggs (Teton) Mission. Specimens obtained from the lower level have counterparts in the Spotted Bear inventory, and suggest that the earlier component of the Cottonwood site was coeval with the Spotted Bear site.

Swan Creek village, located on the top and east and south slopes of a knoll surmounting the second terrace above the wooded flood plain of the Missouri River and the narrow valley of Swan Creek, comprised the remains of three occupations. A, the earliest, which was marked by no discernible fortifications or domiciles, occurred as a refuse blanket over the entire village site. B and C–D, which were successively later, fortified areas of circular, semi-subterranean earth lodges and conspicuous refuse mounds, extended respectively over the eastern two-thirds and over the western one-third of the knoll, and included some related earth lodges and refuse heaps (in occupation area D) on the south slope beyond the area B fortifications. Occupations B and C–D, but not A, produced artifacts of trade metal; and B, but not A and C–D, yielded some secondary human burials. All three occupations produced artifacts of stone, bone, antler, and shell; body sherds that are predominantly simple stamped, incised or brushed; and rim sherds of several types, notably those grouped under the newly described Akaska and Le Beau wares. In A, Akaska and Le Beau types occurred in the ratio, 5:4; in B, 1:5; and in C–D, 1:8. Examples of two other types, Nordvold Horizontal Incised and Talking Crow Brushed, were associated with all three occupations, the former decreasing, and the latter increasing, through time. Stanley types were associated only with B and C–D, and were proportionately twice as common in C–D as in B.

The Swan Creek cemetery, east of the village, contained primary and secondary inhumations of several types which were frequently covered or separated by wood slabs or sticks. In 1954–55, Hurt unearthed the bones of more than 78 individuals of all ages, stained occasionally with red ocher but accompanied by few grave goods — some finely flaked "ceremonial" points or knives, coiled basketry fragments, and beads of shell, copper and glass. In 1920–40, William H. Over and a colleague removed from the same area 36 primary or secondary burials and a wide range of associated artifacts, including a small bird-effigy pot and large points or knives similar to those found by Hurt.

Site 39WW300 is an area of low refuse mounds, southeast of Swan Creek village, and site 39WW301 is an area marked by a low refuse mound, refuse pits and a grave holding several secondary burials, south of Swan Creek cemetery. Rim sherds of Akaska and Le Beau types, the most popular types at both locations, occurred in the ratio of 2:1 at 39WW300 and 1:2 at 39WW301.

Hurt assigns Swan Creek A, site 39WW300, and (on shaky grounds) the primary inhumations of Swan Creek cemetery to the Akaska focus. He places Swan Creek B and C–D, the Spotted Bear site (identified in the first report as a component of the Spotted Bear focus), presumably site 39WW301, and the secondary inhumations of Swan Creek cemetery (for reasons not satisfactorily demonstrated) in the Le Beau focus. Hurt believes that the two foci represent a cultural continuum. Using the Phillips Ranch site, not documented in the historic accounts but rather well furnished with European trade items, as a base-line, he arrives at a bracket date of A.D. 1675 to 1725 for the Akaska–Le Beau sequence.

Hurt's excavations at the Spotted Bear and Cottonwood sites, while lacking in polish, seem to have given adequate samples of these relatively simple areas of occupation. But his investigations of the highly complicated Swan Creek village leave much to be desired in technical precision and scope. The reports are marred by hasty writing, with too great reliance on "typing" and tabulating the data rather than on narrative descrip-

tions and compilations of them, and by inordinate numbers of misprints. One might wish that Hurt would make the results of his field researches as clearly understandable as he has made them readily available, for his record in the latter respect has been truly admirable.

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Pecos, New Mexico: Archaeological Notes. ALFRED VINCENT KIDDER. Papers of the R. S. Peabody Foundation for Archaeology, Vol. 5, Andover, 1958. xx+360 pp., 72 figs., 8 tables, 5 appendices. $7.50.

We who know the author expected this long-awaited book to be no less than a model of archaeological reporting; and so it is. It is more than its modest title suggests. The channel of search and analysis is never lost sight of, is even relentlessly pursued throughout this study; and yet the book is so rich in divergences from the usual impersonal site report that a closing of the final page leaves the impression that here is literature, replete with quotable passages, as well as a classic of science. Since no archaeological report quite like it has ever before appeared, the following observations are not critical, in the sense of wishing something had been otherwise, but a warm statement of appreciation.

The central purpose of the study is no different from the purpose of all sound archaeological studies: an attempt "to reach the solid ground of cultural and historical fact," as the author puts it. But his extension of this thought is more than a definition:

> I find I am today less concerned with the old site's pottery than I am with its human problems. Were I to tackle the job again — no, come to think of it, I couldn't have got much of anywhere toward solving these problems without the knowledge of the Pecos as potters and workers in stone and bone and shell, to which I devoted so much of my time. That, in the teens and twenties was fundamental.

Kidder's oft-repeated theme is that material remains have value only as they illuminate human behavior, beliefs, hopes, accomplishments, or failures. Toward the achievement of this ultimate purpose, he feels that he did not accomplish as much as he had hoped to:

> Some of my errors and oversights were due to inexperience; most of the oversights, however, were caused by the preponderance of my interest, during the teens and early twenties, in pottery and other sorts of artifacts rather than in their makers.

He is careful to remind us that these comments are made 30 years after his field work was done. This subtly underscores what perhaps we all know but are reluctant to admit: that one's point of view and notion of what has real meaning change through the years, that the enthusiasm of the single-line analyst needs to be directed more deeply.

Also, he regrets that he had only ten field seasons at the Pecos site, from 1915 to 1929, when Carnegie Institution of Washington sent him off to head important studies of the Maya civilization. He regrets that not more of the ceremonial rooms and kivas at the Pecos ruin were excavated, and publication of his "notes" was so long deferred. But to his colleagues, all of us his students, what he accomplished both in the field and in the recording of his work compels us to take exception to his unattainable aspiration; to admire his modesty but to refute it. His accomplishment is immense.

Nearly half of the book is devoted to the Pecos kivas which, without detracting from the rest of the volume, represents a contribution of first importance to Southwest kiva literature. The ethnological present is heavily drawn upon to explain the past. Nowhere has this been more meaningfully done than here, and the chapters dealing with the occult and material aspects of kivas are goldmines for anyone trying to unravel knotty kiva problems.

In thinking back over this document, apart from its scientific import, there emerges in the mind a picture in which the figures, no matter when they lived, seem contemporaneous and understandable. At many moments the dominant purpose of archaeology is achieved; to make a dusty mound lost in the scrub juniper of a New Mexican mesa-top tell its story. The picture of the departure of the Pecos people from their early village of Forked Lightning and the founding of the Pueblo of Pecos is most evocative.

Almost as many new puzzles emerged as old ones were resolved, enough in fact to offer Southwestern archaeologists a fertile field to occupy them for many years. The challenging questions his work poses are, alone, a stimulating contribution. For example, Pecos was at one time a great Pueblo, prosperous, secure, standing three or four stories high, with a population of possibly 2000 persons. And then:

> Pecos perished. Why this once great Pueblo failed to survive is, as I have said, a problem. The community was already on the down grade, as indicated by its dwindling population in the first half of the eighteenth century. . .
> Were internal rifts partly to blame? Titiev (1944) has shown in his discussion of Oraibi's disintegration that Pueblo communities have been, and still are, prone to damaging intramural feuds. Or had droughts, epidemics, and other tribulations resulted in the Pecos losing heart, with their women ceasing to have babies, as Juan Gonzales once feared might happen at San Ildefonso? Or was there a slow, weakening drainage of discouraged or disgruntled individuals or groups, seeking less worrisome lives in other towns?

Though many of these questions go unanswered, the effect of the Spanish conquerors and the Church, and of the Apaches and Comanches on the Pecos people is sufficiently understood by a discrete drawing of inference to indicate the nature and extent of their influences.

Consider the usual accusation that predatory tribes were the primary cause of all Pueblo migrations. It does seem now that the original, planned pueblo of Pecos was built with defense in mind. But, in Kidder's more penetrating view, the motivation of its abandonment, at least, is not so simply explained:

> I hesitate to assign full responsibility for Pecos' extinction to Comanche hostility, whether it was due to pure "cussedness" and a Viking-like love of raiding, or because they had developed a lasting desire for what, in better times, the Pecos could supply them. Contagious diseases, brought into the New World by the Spanish or their Negro slaves, must have been a potent element in the decline. . . . One is inclined to look for some less obvious cause, perhaps some inner defect.

Self-containment and self-sufficiency played, I believe, no small part in saving the Pueblos from the spiritual and material decadence that has overtaken so many other Indians. But they possess very little spirit of inter-Pueblo solidarity, which in earlier times might have allowed them more successfully to have resisted savage enemies. The same lack of cohesiveness today causes much difficulty to those who try to bring Pueblos together for common betterments of one sort or another.

The archaeologist seems compelled to admit that in these vanished people there was possibly some "inner defect." It may not be scientific of him to regret this; but it is mightily human.

Concerning the contributions of other archaeologists who also worked at Pecos or in related areas, Kidder is most generous. However, he observes and tactfully rectifies their mistakes, as for example, Bandelier's early description of South Pueblo (p. 109).

Concerning his own mistakes, Kidder is not so gentle, and records them in precise detail:

Not yet having learned, as I did later, that the Pecos were forever working over their kivas, laying new floors, renovating firepits, and remodeling deflectors, I failed to take up what was presumably only the latest floor, probably missing sundry alterations.

And there are other confessions of fumbling. However, it is clear enough that these self-reproaches are no indulgence; they are educational, cautionary, politely indirect, but meant for us.

Pecos, New Mexico stands as a unique report. There will never be another quite like it. But all future books of this nature will, it is hoped, be enriched by it. Certainly, as an example to young students in whatever field, it will be a lasting challenge — in its clarity of scientific intent, precision of observation, pattern of unfoldment, and natural, readable and yet authoritative style. Also, it is a lesson in patience, as well as proof of the value of a powerful imagination to the study of archaeology.

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Digging into History. Paul S. Martin. Chicago Natural Museum, Popular Series, Anthropology, No. 38, 1959. 157 pp., 1 fig., 10 drawings, 39 pl., 1 map. $1.50.

Archaeologists who are seeking books to be used in courses and who are frequently asked if there is a book about prehistoric life in the Southwest suitable for a lay audience must be fully aware that there is not a single adequate publication on the archaeology of the Southwest as a whole. The few such books that do exist are hopelessly out of date. This book does not fill this need; it does not attempt to. It does, however, provide an excellent account of one of the groups that occupied the Southwest in prehistoric times, the Mogollon.

Without distorting facts and adding false glamour Martin has attempted to put some flesh on the bare bones of archaeological knowledge and tell something of the way in which these ancient people lived and how cultural changes occurred, instead of concentrating wholly on that portion of the artifact assemblage that has survived the passage of centuries. He has also provided information that will answer many of the questions of laymen about how ruins are found and how they are studied. Surely no archaeologist has been able to avoid the ubiquitous questions: How do you know where to dig? How do you know how old it is? What's the use of Archaeology? Surely everyone will agree that it is not easy to give clear and simple answers.

Basically, this is an account of the knowledge gained by Martin and his associates in the 12 seasons during which they excavated Mogollon sites in west central New Mexico that covered a time span of some 4000 or 5000 years. Under the headings, "The Time of Limited Wandering, Emergence of Small Sedentary Communities, The Beginnings of Town Life," is given a concise account of the information gathered regarding the obtaining and preparing of food, the construction of houses, the making of tools and pottery — the general material basis of Mogollon culture. There are also conjectures regarding non-material elements such as social organization, ceremonies, and beliefs.

Anyone teaching a course in Southwestern Archaeology will find this attractive and well illustrated book very valuable. The discussion of a variety of cultural factors should also make it useful in introductory courses in anthropology, and it can be recommended to interested laymen.

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Reports of the University of California Archaeological Survey, Nos. 1–45. University of California Archaeological Survey, Department of Anthropology, University of California, Berkeley, 1948–1959.

The Reports of the University of California Archaeological Survey are many and varied. The UCAS was established in 1948 as a permanent activity of the University of California at Berkeley. In 1958 another office of the UCAS was opened at the Los Angeles campus of the University. The purpose of the UCAS has been to "study and make known to the general and scientific public the prehistory of California." The reports indicate that the UCAS is succeeding admirably in its stated aim. Since 1948, 45 reports have been issued. Their range is extremely broad. There are accounts of surveys and site excavations, discussions of methods and techniques, and papers on ethnographic matters of interest to the archaeologist. There are articles which deal intensively with the description, distribution, and significance of items of material culture and there are reprints and translations of hard-to-find articles. The physical type of prehistoric Californians has not been neglected. Very useful bibliographies have been included. The subjects range from early man to Russian and Spanish remains in California. All areas of the state are included in their scope, from north to south, from the Farallon Islands in the west to central Nevada in the east. The

reports range from a two-volume synthesis of Central Californian archaeology to the short *Papers on California Archaeology*, several of which may appear in the same volume.

The reader will be impressed with the extensive bibliographies that each paper includes. Every paper is further characterized by the most careful referencing. The research of these California scholars has been most thorough. Along with the reports on the archaeology of an area they include a wealth of information on the ethnography of the historic aboriginal inhabitants, on physical type, on natural history, on whatever may be pertinent. Volume 31 is an index through 1955, which further adds to the usefulness of the series. Though this series is invaluable to the student of California archaeology its value does not end there. Students of the Great Basin will profit by the interest the University of California has had in that area. Those concerned with the problem of the antiquity of man in the New World will find several provocative articles. All archaeologists will be interested in the papers dealing with methodology. It is difficult to choose specific articles to draw to the reader's attention. The few mentioned are illustrative of the range of the series.

A Bibliography of Ancient Man in California, No. 2, 1948, compiled and edited by Robert F. Heizer, is the first of several excellent bibliographies in the series. A thorough discussion of the whole problem of early man in California precedes the bibliography. The author concludes that although the existence of early man in the area is probable and some finds seem to indicate it, no completely authenticated, unquestionable discovery of early man has yet been made in California. The bibliography, which is complete through 1948, lists the references for each site together, and gives annotations when comments are helpful to clearer understanding.

Molluscan Species in California Shell Middens, No. 13, 1951, by Robert E. Greengo, should be of interest to all who have ever dug in shell middens. Greengo has shown by quantitative analyses of refuse deposits that there are variations through time in the proportions of different molluscan species in the San Francisco Bay shellmounds. He has further suggested that this variation may well be correlated with a rise in sea level. Samples having a constant volume were taken from each mound on a vertical plane. These were sorted and weighed and the proportions of the components calculated. This analysis revealed the changing proportions of molluscan species.

Gravel Pictographs of the Lower Colorado River Region, No. 20, 1953, by Michael J. Harner, is an example of one of the shorter papers of the series. Harner takes up a discussion of the curious anthropomorphic and theriomorphic alignments of gravel occurring along the Lower Colorado River. The location of all known sites, their description, reports of earlier observers, ethnographic information, speculations as to their purpose, drawings, and photographs are all included.

Temporal and Areal Relationship in Central California Archaeology, Nos. 24–25, 1954, by Richard K. Beardsley, is the longest article in the series and in many respects the most central. It is an ambitious attempt to synthesize the archaeology of Central California. By Central California the author means the area around San Francisco Bay, Marin County to the north, and the Sacramento Valley to the east. Three cultural horizons, the Early, Middle and Late, are established for this area, which is divided into two areal zones, the Littoral and the Interior. The archaeological remains are divided into *Components* which represent human occupancy at a single location at a specific time. Components are grouped into *Facies*, which are vaguely defined as groups of intimately related components. Facies are grouped into *Provinces*, which are geographic units. I found this classification to be somewhat cumbersome. However, the material remains are carefully described.

Sonoma Mission — An Historical and Archaeological Study of Primary Constructions, 1823–1913, No. 27, 1954, by James A. Bennyhoff and Albert B. Elsasser, summarizes excavations within the quadrangle area at Sonoma Mission. The remains of a structure were unearthed. A complete description of the finds and a reconstruction of the original appearance of the Mission, illustrated by easily read charts and drawings, forms the bulk of the report. Included are a discussion of all previous references to the Mission and early drawings and photographs of it. The recollections of the Mission by an early resident of Sonoma appear as an appendix.

Archaeological Radiocarbon Dates from California and Nevada by Robert F. Heizer and Gordon L. Grosscup; *Some Archaeological Sites in Western Nevada* by Norman L. Roust, Martin A. Baumhoff, and Albert B. Elsasser, No. 44, 1958. Part I of this number is composed of two articles. In the first Heizer lists and discusses radiocarbon dates from California. Grosscup does the same for radiocarbon dates from Nevada. A discussion of the context and significance of questionable dates makes this report much more useful than the usual unannotated date list. Part II contains three short articles describing three sites in Western Nevada.

The Aboriginal Population of the Great Basin, No. 45, by K. A. R. Kennedy, 1959. This report, the most recent of the series, deals with the physical anthropology of this area. Kennedy has brought together published data on skeletal material and on living subjects. To these he has added a description of the Great Basin skeletal material in the Museum of Anthropology at Berkeley.

Space prevents an adequate review of the whole series. All students of archaeology, whatever their specialties, will profit from a perusal of these Reports.

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Mixtec Ethnohistory, A Method of Analysis of the Codical Art. PHILIP DARK. Oxford University Press, London, 1958. 61 pp., 7 figs., 2 tables. $4.80.

In his study of Mixtec codices Dark presents what he terms a new methodological approach to the study of

codices. In so doing he selects the Zouche-Nuttall group to demonstrate the application of his method — codices the content of which is not completely understood. In assessing their probable content he rejects the view of Seler, that the subject matter is largely religious or mythological, and inclines more to the view of Cooper-Clark, Long, Spinden, and Caso, that the content is historical and genealogical. As an application of his methodological procedure, he works out the genealogical pattern of the Codex Selden and the Codex Bodley.

Dark labels his procedure the Ideographic-Iconographical Method, which, in effect, is two systems of analysis. The first, the Ideographic method, is "a form of shorthand representation of the subject matter." The method entails three stages of analysis. As the first stage, individual glyphs or glyph relationships (male, female, name, place, posture) are reduced to symbols (lines, directional lines, wavy lines, arrows) which become Dark's ideographs. As places, persons, dates, and so forth, are combined to constitute a configuration or a scene in the codex, so, too, Dark combines his separate symbols.

The second stage of analysis is really a second level of abstraction whereby the ideographic symbols are reduced to other more manageable symbols (numbers and letters). Thus, on encircled 1 represents "a female and a male sitting on a place facing each other."

In the third stage assumptions are made as to the meaning of the abstracted ideographs. In short, the ideographic record yields patterns, and the patterns yield meaning. For example, it is assumed that the relationship expressed by the ideograph for a female and a male sitting on a place, facing each other, is that of a married couple. A second assumption is that individuals connected to a couple by an umbilical cord are children of that couple. A third assumption is that footsteps leading from a couple to the partner of another couple indicate that that individual is the child of the first couple. In tabulating the genealogies of the Codex Selden, Dark discovers a patterned variation in the place of origin of the footsteps leading to an individual. A different meaning is postulated for this variation of pattern, that is, three generations (grandparent, parent, and child) are indicated rather than two (parent and child). Dark then proceeds to demonstrate that the new pattern indicates three generations by a consideration of attendant date glyphs.

The Iconographic Method, or the Aspect Sheet system, resulted from Dark's work with the Human Relations Area Files at Yale University. An internally punched card was devised which locates a glyph element as it occurs on the pages of three related codices. As an example, if the punched card, here termed Aspect Sheet, for the number six as an element in a name glyph is combined with the card for monkey as an element in the name glyph of a woman, the location of a woman or women named Six Monkey is immediate. Also assumptions as to meaning can be coded and tested. Dark forms the hypothesis that the relationship expressed by the ideograph M followed by the encircled 1 (the left hand person only of a couple seated on a 'marriage mat') in the Codex Bodley is that of a married couple and is the same as the ideograph, encircled 1, in the Codex Selden. By the manipulation of the aspect sheets he demonstrates that this correspondence is valid.

Dark asserts that his method, when applied to the analysis of historical codices, is a more objective approach which facilitates "the discovery of the patterns of relationships suggested by the visual impressions of the various symbols depicted." The method has merit, and limited application in the decipherment of codices. However, it is most effective when used by investigators such as Dark who already possess a working familiarity with codex content. Most effective results are obtained for shorter time periods, perhaps three centuries. In the remote past, where history and myth merge, genealogical patterns become blurred. He is cognizant of this when he states that "in the first ten pages of the codex there are some eleven, possibly ten, unrelated blocks of genealogies, whereas in the last ten pages there is one block of related personages."

Because of Caso's already published studies of the genealogies in the Mixtec codices, Dark is able to compare the results of his method with Caso's "subjective" method. It is difficult to see how the superiority of the new method is demonstrated when Caso's time calculations are cited as substantiation (pp. 31, 32, 51). Disagreement with Caso's number of generations and dates seems to be based on whether a generation is to be reckoned as 20 or 25 years, rather than on the merits of the two methods (pp. 9, 31). Finally, the unique events of the historical codices are not likely to be filtered out by the discovery of patterns of relationship.

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The Archaeological Ceramics of Yucatan. GEORGE W. BRAINERD. Anthropological Records, Vol. 19. University of California Press, Berkeley and Los Angeles, 1958. iii+378 pp., 113 figs., 3 pls., 24 maps and plans, 24 charts. Cloth $8.00, paper $6.00.

For many years students in the field of Maya archaeology have been awaiting the publication of the work of George Brainerd on the pottery of Yucatán, with the knowledge that it was a study both broad and exhaustive that would fill a great gap in knowledge. Since 1927 when Vaillant presented his thesis on Maya pottery, which remains unpublished, there has been no specific study on the ceramics of Yucatán. In contrast, there have been numerous adequate monographs on the architecture of the region. It was known that Henry Roberts had collected an enormous quantity of ceramic material from Chichén Itzá, the Puuc region, Yaxuná, Cobá, and Holactún, but his study was never finished. It was known also that Brainerd had begun his research nearly 20 years ago and that the work was virtually completed long ago. For these reasons the University of California has made a great contribution in publishing the important work of this brilliant investigator. Brainerd had the satisfaction of knowing that the results of his

long investigation would finally be published, but unfortunately he did not live to see the publication completed. His death was a severe loss to archaeology.

Brainerd's work is characterized by the presentation of a wealth of material, the minute and exhaustive analysis of pottery types, and an attempt to synthesize his data and interpret them in terms of the history of the Yucatecan Maya. It reflects the qualities that Brainerd had as an investigator — meticulous observation, exactness, clarity, intelligence, and intuition.

Brainerd's investigation was made difficult by a number of circumstances. A major portion of the available ceramic material was not collected by him but by other investigators during an extended period of exploration and excavation in Yucatán, particularly by Henry Roberts, whose notes were incomplete. These collections were stored for many years in Chichén Itzá. The ravages of climate, termites, rats, and cockroaches destroyed many boxes, bags, and labels and resulted in the mixing of collections. These obstacles did not discourage Brainerd from making the maximum possible use of these collections.

But Brainerd's investigation rests most securely on ceramic collections gathered by himself in stratigraphic excavations at various sites in Yucatán. This material came not only from ruin debris and from offerings found in structures or accompanying burials, but also from refuse deposits in the base of terraces or deposits in cisterns, caves, and cenotes, and from test pits in platforms. This great variety of provenience compensates in part for the lack of deep stratified deposits in Yucatán, a lack due to the extreme shallowness of the soil.

Although Brainerd's book is called "The Archaeological Ceramics of Yucatan," among the sites that he included in his ceramic studies are several outside Yucatán, such as Cobá in Quintana Roo and Holactún (Xcalumkín) in Campeche. If he had intended to treat together the ceramics of the entire peninsula of Yucatán, then several extensive regions with numerous important centers of occupation would be lacking. But it is clear that he intended to cover not the whole peninsula but only the state of Yucatán, and that the Cobá and Holactún materials were included so as not to waste Roberts' collections and data and because of their value for comparative study.

In treating the ceramics of each site Brainerd notes the architectural characteristics and the associated dates, where these exist, in an attempt to combine and reconcile the data from monuments, inscriptions and pottery.

Brainerd has selected for description only pottery types that are useful in establishing phases within the history of the Mayas of Yucatán. He follows this selective criterion also in setting up classes of vessel shapes. For each pottery type he describes concisely the characteristics of surface, paste, decoration and form. He adds comparative data on the occurrence of each type within Yucatán and in the Maya area in general, and extends the discussion to an even wider area in the case of such widely diffused types as Fine Orange "X."

Brainerd places each pottery type within a chronological sequence. His period names (he calls them stages) follow in part those used by other investigators and in part they are different. He divides the prehispanic epoch into a Formative period with early, middle and late phases; a Florescent period; and a Mexican period with early, middle and late subdivisions. These four periods correspond to those more generally called Preclassic, Early Classic, Late Classic, and Postclassic. He discusses also an "interregnum" covering the century preceding the Spanish conquest. Brainerd's placement of the various pottery types in periods and phases is based on stratigraphy wherever possible, but also on associated dates and on ceramic cross-ties with the Petén and other areas with established chronologies.

Brainerd devotes a chapter and one of his synoptic charts (Chart 22) to the question of the bearing of his ceramic analysis and the periods derived from it on the problem of the correlation of the Maya and Christian calendars. After expressing the reservation that a ceramic chronology is necessarily relative and that dates derived from it can never be precise or certain, he concludes that the Thompson correlation best fits the ceramic data. He rejects the Spinden correlation because of the excessive duration it requires to be assigned to the Florescent (Late Classic) and Mexican periods, and the 11.3.0.0.0 correlation because of its extreme compression of the Florescent period and because it requires a too early placement in the Maya calendar of the Toltec phase at Chichén Itzá.

In an interesting chapter called "The Development of Yucatan Ceramics: A Trial Formulation" Brainerd attempts to trace the history of Yucatecan ceramics. After an account of contemporary pottery techniques in Yucatán, he discusses the clay, temper, slips and paints used in the prehispanic pottery. He regrets the lack of detailed technological studies of these different aspects of Yucatán pottery, with the notable exception of Anna Shepard's studies of temper. There follows a study of the ceramic traditions through time seen in the various wares in terms of the characteristics of temper, slip and paint. The continuous or discontinuous use of these traits and their appearance, disappearance and reappearance through time are treated in detail in the text and summarized in Chart 23. Brainerd insists that an analysis of the materials composing pottery and the techniques of its manufacture can reveal interrelations between the pottery-making centers of Yucatán, establish their connections with other centers, and help in the dating of pottery types. Next he discusses in detail the occurrence in time and space of the various ceramic wares and vessel forms. The consideration of the chronological position of forms is one of the most important aspects of Brainerd's study. Because of the small number of wares, the rarity of decoration, the continuity in slip tradition, and great variety of vessel forms in Yucatán, shape is the most practicable criterion for establishing cultural and chronological diagnostics.

In the final chapter Brainerd gives a synthesis of the conclusions he has been able to extract from his long and minute study of ceramics made in order to clarify

Yucatecan culture history. The ceramic data make it perfectly clear that the peopling of Yucatán dates from the Formative stage (Preclassic), when there were numerous occupied sites, and not from a time of late migrations from the southern Maya area. The occupation of Yucatán seems to have been less dense during the Regional (Early Classic) period, when ceremonial stone structures appeared. In the Florescent (Late Classic) period, characterized ceramically by slatewares, there was the great architectural development and Yucatecan Maya civilization reached its apogee. The Mexican period (Postclassic) includes three subperiods, which, as a result of the Carnegie Institution of Washington's excavations at Mayapán, are now better understood than when Brainerd's book was written. The Mexican period corresponds first to the Toltec occupation and later to the rise of such cities as Mayapán and Tulum, which show strong Mexican influences. Brainerd mentions a Postconquest period in order to record the survival of the old technical traditions among the Yucatecan potters.

The text is completed with several pages of bibliographic notes related to the text and an extended bibliography. There follow 109 figures with corresponding descriptions that constitute Brainerd's major contribution. They bring together 10,000 drawings depicting some 6000 ceramic specimens — silhouettes of whole vessels and rim sherds, bases, walls, handles, supports and other details, decorative motives, figures, seals, and so forth — neatly drawn and adequately ordered by types. The profusion of drawings is such as to appear excessive, sometimes with a repetition of similar elements or minor variations that appear to be without taxonomic significance. Perhaps it would have been possible to reduce the number of these illustrations without sacrificing a single type, form, or decoration, and to achieve less crowded and more easily consulted figures. But it is clear that Brainerd wished to leave to the specialists the maximum of material and was determined not to eliminate anything of possible interest in the study of Yucatecan ceramics.

The general and regional maps (many reproduced from previous publications, principally of the Carnegie staff) and the plans and sections of cenotes show the exact provenience of each of the ceramic collections used in Brainerd's study. Finally, 24 synoptic charts synthesize graphically the distribution of pottery types by site; the frequency at several sites of certain types, principally slipped wares; the stratigraphic placements in the Yucatecan pottery sequence of the principal pottery types, listed by site; the comparison of Brainerd's cultural periods with those of the Petén and the Valley of Mexico, shown in conjunction with the three principal correlations of the Maya and Christian calendars; and the occurrence through time and by ware of the various types of temper, slip, and paint. The book closes with a series of photographic plates illustrating modern ceramic techniques in Yucatán.

Because the publication of this work was so long delayed, some of Brainerd's conclusions have become disputable in the light of the most recent studies (for example, Robert E. Smith on the Puuc, Chichén Itzá, and Mayapán; E. Wyllys Andrews on Dzibilchaltún). Nevertheless, this book is indispensable to all students of Maya culture. Its publication is a well deserved monument to the memory of a gifted archaeologist.*

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Modern Yucatecan Maya Pottery Making. Raymond H. Thompson. Memoirs of the Society for American Archaeology, No. 15, Salt Lake City, 1958. x+157 pp., 48 figs. $2.50.

There is more to this volume than its title indicates. It contains not only an ethnographic study of pottery-making, but also a treatment of the manner in which archaeologists infer the behavior of making and using pottery from their artifacts. The assignment of the present reviewer is to consider the archaeological aspect of the work; the ethnographic aspect is covered in the accompanying review.

The volume begins with a chapter entitled "The Conceptual Setting," in which Thompson discusses the principles and procedures of inferring behavior from archaeological artifacts. In my opinion, this is an excellent discussion — comprehensive, succinct, and well reasoned. Thompson makes the point that archaeologists are "faced with the difficult task of maintaining some sort of balance between [the] 'pragmatic' foundations of his method and the 'idealistic' trends of anthropological theory" (p. 2), and he himself does a good job of it. He shows clearly that there is a strong subjective element in archaeological interpretation of artifacts and presents a scheme for conceptualizing it. From this standpoint, alone, the chapter might well be made required reading for the next generation of archaeologists. It would serve as a corrective for the common tendency to believe that, because archaeology deals with artifacts and other material remains, it is predominantly an "objective" science.

In subsequent chapters, Thompson presents an "experiment" in which, first assuming the role of an archaeologist, he infers the behavior of the artisans from his modern Maya artifacts and then, shifting into the role of an ethnologist, gives his observations of the ways in which the Maya actually made and used the artifacts. The design for this experiment is clearly stated and it is well carried out.

In the archaeological part of the experiment, Thompson follows the procedure I have used in analyzing Caribbean artifacts into "modes," that is, kinds of parts of artifacts; and "types," or kinds of whole artifacts (*Yale Univ. Pub. in Anthro.*, No. 24, 1941). From the modes, he then proceeds to infer the behavior of manufacture and use. This is done in almost painful detail, but the detail is justifiable in a study of method such as this.

* Translated from the Spanish by Donald Collier.

In the ethnological part of the experiment, Thompson follows the approach of Cornelius Osgood in "Ingalik Material Culture" (*Yale Univ. Pub. in Anthro.*, No. 22, 1940). For each type of artifact, he presents appearance, in the form of an illustration, and then goes on to the Maya name for the type, its materials, construction, and use, all based upon his observations in 11 pottery-making centers he studied in 1951.

To be completely successful, an experiment of this sort should produce comparable bodies of data, one archaeological and the other ethnographic. It does so on the level of types, but on the level of the artisans' behavior, the two parts of the experiment differ in one significant respect and are, to that extent, not comparable. The archaeological procedure of analysis has no counterpart in the ethnographic approach, where the artifacts are treated only as whole objects. It is, of course, necessary for the archaeologist to do analysis in order to obtain the basis for inferring the artisans' behavior, whereas the ethnologist need only observe the behavior; but Thompson goes further with analysis than he needs to for this purpose. He presents not only the evidences of the manner in which the artisans made and used the artifacts, but also the concepts which they expressed in the artifacts, including designs, rim profiles, and handle types. These are not in themselves indicative of behavior, and therefore seem out of place in a procedure designed to get at behavior.

Conversely, in the ethnographic description, Thompson pays practically no attention to the elements of shape and decoration. Instead, he follows Osgood's definition of "techniculture" as the behavior involved in making and using the artifacts and thereby omits the concepts of shape and decoration expressed in the artifacts which, in Osgood's system, are "mental culture." The experiment could have been sharpened and a great many unnecessary details eliminated if the techniculture approach had been followed in the archaeological as well as the ethnographic part of the study. This would also have given a fairer impression of what can be accomplished through archaeological inference. As it is, the archaeological inferences seem richer in detail relative to the ethnographic observations than they would have if shape and design concepts had been omitted from the former or added to the latter.

In fairness to Thompson, I should point out that he submitted the manuscript to me for criticism before publication and that I failed to note the foregoing point, although I did express an intuitive feeling that his archaeological and ethnographic sections were not comparable. This goes to show how difficult the field is. Thompson is to be congratulated on an important and successful pioneer effort in it.

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Contemporary Yucatecan potters form vessels on a *kabal* which, in its most common form, is a wooden disc 10–16 cm. in diameter and 6–10 cm. high. One flat end of the *kabal* rests on a working board on the ground, while the other end supports the paste, from which a pot is made by modeling or piece construction. Other *kabal* types are square, or take the form of clay saucers. The feature common to all is that they are turned with the toes or soles of the feet of male or female potters. In 1896 Henry Mercer suggested that the *kabal* was a survival of a pre-Columbian potter's wheel, and since that time many pottery students have been intrigued by this hypothesis.

In the ethnographic sections of this report Thompson outlines in meticulous fashion the history of contemporary (that is, non-archaeological) pottery research in Yucatán. Drawing on his own field notes he then describes the full process of pottery making in the 11 towns where the work continues. Although the stated purpose of the ethnographic research is to "serve as the basis for an investigation into the nature of archaeological inference" (p. 24), time may prove that Thompson's greatest contribution lies in giving us, after 60 years of bit reports, a superb and detailed account of an unusual technique. The reader is left with few unanswered questions. For the first time the total range of *kabal* forms and methods of use are set forth, and vessel types are described in detail. This is the most complete comparative study of contemporary pottery techniques in a given area (as contrasted to pottery production in a single community) known to me.

Armed with complete ethnographic data, Thompson is able to compare Yucatecan techniques with those in other parts of Mexico and Guatemala, and the Americas, and then to consider the question as to whether the *kabal* should be thought of as an incipient or degenerate wheel. He points out that the *kabal* is a specialized variant of the widespread American mobile pottery support (for example, the Pueblo *puki* and the Oaxaca *molde*), and in this sense not absolutely unique. In order to relate mobile pottery supports to possible evolutionary steps in wheel development Thompson briefly considers the characteristics of wheel-thrown ware — particularly the use of centrifugal force — and correctly concludes that because of low speeds and lack of centrifugal force, as well as lack of a pivot, the *kabal* is in no way a potter's wheel.

A minor correction, stemming from new data, is indicated on one point. Thompson says that no other case of a foot-turned mobile support is known in the New World. In April, 1959, I found the Mama-type pottery-saucer *kabal* in common use in Acatlán, Puebla, where it is called *parador*. The *kabal* must be considered as more than a Yucatecan phenomenon. [A descriptive and comparative paper on the Acatlán *parador* will appear in a future issue of AMERICAN ANTIQUITY. — EDITOR.]

Modern Yucatecan Maya Pottery Making is a "must" for Mexicanists, whether ethnologists or archaeologists, and for all students of comparative pottery techniques.

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Tikal Reports, Numbers 1–4. E. M. Shook, W. R. Coe, V. L. Broman, and Linton Satterthwaite. Museum Monographs, University Museum, Philadelphia, 1958. vi+150 pp., 26 figs. $2.50.

Someday we may look back on the Tikal Project as the climax of the past half century of Maya research — the biggest dig at the biggest site — and also as the outstanding example of the new approach in archaeology, with emphasis on the use of varied scientific disciplines, on restoration, and on arousing popular interest. It is an ambitious and complex undertaking, aimed at both a better understanding of the rise and fall of the largest of the Petén ceremonial centers and at restoring and stablilizing enough of the site to make it a major tourist attraction. As Rainey says, "If we succeed, Tikal will become a breath-taking experience for countless people, and it will teach them directly that a stone-age technology and a hostile environment did not here prevent development of true civilization" (*University Museum Bulletin*, Vol. 20, No. 4, p. 15).

These four reports on the work at Tikal are in quite a different vein, however, presenting in straight-forward style the details of two seasons' archaeological research. In *Report No. 1* Shook summarizes the objectives of the project and the accomplishments of the 1956 and 1957 seasons — aside from the necessary attention to finding a water supply and building a large, permanent field camp. A new Late Classic monument and its associated altar were found, the concept of the "twin-pyramid complex" was developed and tested, a detailed site map was begun, additional inscriptional studies were made, the wooden lintels at the site and elsewhere were analyzed, and the immediate vicinity of several monuments and small structures was excavated. *Report No. 2*, by Coe and Broman, describes the excavation, in the area of the new carved stela of Stela 23 Group, of what appears to be a small, peripheral religious center, a half-hour's walk from the main plaza, used during the final years of Tikal's decline. *Reports No. 3* and *4* are both by Satterthwaite; one outlines the problems of studying stelae that are broken, moved, or re-set, and reports details of seven fragmentary Tikal stelae. The other analyzes in highly technical form the inscriptions of several monuments and discusses the problem raised by gaps in the sequence of datable inscriptions at the site.

For specialists in the archaeology of the Petén these reports will be invaluable. For others it would have been helpful if the evaluation of the raw data had been expanded, although the stated aim of this series is to provide only the data on which future syntheses will be based (p. 8). Since there is hope that the full ten-year program planned for Tikal can be financed and carried out, it will be reassuring if at least interim syntheses and summaries for the non-Mayanist appear before the completion of the entire project.

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Thomas Gage's Travels in the New World. Edited by J. Eric S. Thompson. University of Oklahoma Press, Norman, 1958. li+379 pp., 10 illus., 2 maps, 15 drawings. $5.00.

This book was first published at London in 1648 and entitled: "The English-American, his travail by sea and land: or a new survey of the West-India's, . . ." By 1722 five more English editions had appeared, five French, and others in Dutch and German. It was evidently of interest to the American colonists, for it was also printed in New Jersey in 1758.

Fabulous riches from Spanish America had long been pouring into the mother country, while England, France, and Holland had as yet little more than a toe-hold in the New World. These countries were casting curious and envious eyes on the source of such wealth, and this book was the only contemporary source of information available. Gage was indeed the only Englishman or other non-member of the Holy Roman Empire who had lived in those regions and was capable of writing about them.

The author came of a noble English Catholic family; four of his brothers were priests. He was educated in France and Spain, and, as a young Dominican friar of about 22, he volunteered in 1625 for service in the Philippines. While passing through Mexico he learned of the dangers and hardships in that field; whereupon he deserted his party and fled, first to Chiapas and then to Guatemala City, now Antigua. Here he studied, preached, and taught philosophy, after which he took charge of missions near the present Guatemala City. He learned the Pokomam language, on which he later wrote a treatise. In 1637 he fled again, this time to Panama, and made his way back to England. Although he was well received by relatives and old friends, he became discontented, and in 1542 he repudiated his faith and joined the Church of England. Civil war was now breaking out in England, and Gage's testimony in court sent several priests, old friends or former associates, to the gallows. He was rewarded by an appointment as rector of a parish in Kent.

As the editor notes, Gage had the ear of leading members of the Commonwealth, including Oliver Cromwell, and as he intended, the book played an important part in the Caribbean expedition which resulted in the capture of Jamaica in 1656. This could account for the crude and offensive slanders of the Roman Catholic priests and friars which appear in the original work. Most of these are deleted in the present edition.

Gage's book is a strange mixture of good and bad. In spite of its defects it is a well-written and lively eyewitness account by an acute observer of the life and everyday events in a new and strange world. He gives us a vivid picture of a sort difficult to obtain from the more impersonal accounts of the historian. Outstanding are his brilliant descriptions of the departure of the Spanish fleet from Cadiz, the celebration in mid-Atlantic, an attack by the Caribs of Guadaloupe, the landing of the Viceroy at Veracruz, and the splendor, wealth, and "scandalous wickedness" of Mexico City. Gage's travel

narrative is never dull. Chiapas, he writes, "held to be one of the poorest countries of America, . . . exceedeth most provinces and yields to none except it will be Guatemala in the greatness and beauty of fair towns." The account of his life in Guatemala offers a portrayal of the country and its inhabitants, including Spaniards, Indians, Negros, and people of mixed blood, which it would be difficult to find elsewhere.

The editor has contributed greatly to the value of this edition, and he is well qualified for the task. A product of Winchester and Cambridge, England, he knows Maya and is bilingual from childhood in Spanish and English. Thompson is a prominent archaeologist and ethnologist and the world's leading epigrapher in the Maya field. Needless to add, he is personally familiar with nearly every part of southern Mexico and Guatemala. The editor's principal contribution is the valuable information about the persons and places mentioned by the author, which is to be found in the introduction and footnotes. Another significant contribution is his happy compromise between retaining intact the style and spelling of 1648 and a complete modernization. It is now easy reading, but it has not lost the flavor of the first edition; and one chapter appears in its original style . The book is illustrated by photographic reproductions showing churches, in England, Guatemala, and Chiapas, as well as an Indian group, and also by pen-and-ink drawings relevant to the text. It contains a good bibliography and is well indexed.

RALPH L. ROYS
Carnegie Institution of Washington
Cambridge, Mass.

Introduction to the Archaeology of Costa Rica. DORIS STONE. 54 pp. 47 figs., 2 color plates, map. Museo Nacional, San José, Costa Rica, 1958.

The Aboriginal Metalwork in the Isthmian Region of America. DORIS STONE AND CARLOS BALSER. 33 pp., 11 figs. Museo Nacional, San José, Costa Rica, 1958.

Stone commences the first of these publications with the words: "This is an introduction to the archaeology of Costa Rica. It is not a book of details." Nevertheless, there is a good deal of detail, especially regarding the many ceramic types. Though cultural resemblances with Mexico and Colombia are noted, and the extensions of the subcultures into or from Nicaragua and Panama are considered, the "Introduction" is pretty well limited to the archaeology of the republic, with which she is familiar as a long-time resident. Illustrations are excellent, with very few errors — for works locally printed; a Spanish edition is mentioned. A small bibliography accompanies the text on each region.

The three principal archaeological regions of Costa Rica are considered independently: the relatively homogeneous Atlantic watershed and Highland region, the western Pacific Coast Nicoya area with its northern affinities, and the southern Diquis region with its relationships with Panama. The geographical and the outstanding archaeological features of each area are outlined, followed by a description of the artifacts — stone, metal, pottery, and other materials, with emphasis on ceramics.

Costa Rica is a "meeting ground of cultures." The Pacific Nicoya Chorotega–Mangue region is the southernmost limit of Mesoamerica, a migration from the north, with dependence on corn; gold is scare. The highland region with its dependence on tubers and pejibaye palm rather than corn, and its causeways is more akin to South America than to Mesoamerica. This is the "exhibition region" from which come the magnificent stone sculptures prized by museums. Some remarkable, recently found wooden objects are illustrated and described. The Diquis region to the southeast is an extension of the Panamanian Chiriquí culture, a unique region of South American cultural affiliations with little dependence on corn, much work in gold, and great stone spheres up to 2.1 meters in diameter and 13.5 tons in weight.

The treatment is distinctly "old style," with no mention of temporal or cultural sequences, "Formative" or "Classic." Not that Stone is entirely unconscious of this important lack, but not enough controlled digging has been done in Costa Rica to establish the cultural sequences — she says, "only two instances of isolated stratification." Nevertheless, one feels that some hypotheses in this direction could have been attempted.

The study of the metallurgy in the second book is naturally more technical and detailed. It is based mainly on and descriptive of a special exhibition assembled at the National Museum in San José for the 33rd International Congress of Americanists. Panama is included as well as Costa Rica.

First the various techniques and processes are fully described, and then the types of artifacts, utilitarian objects and ornaments. The tools used are noted as well as the ornaments. The objects are mainly of gold, almost always of gold and copper alloys in various proportions, but those principally of copper are rare. The ore was secured by placer mining. The technique of sintering was unknown. An appendix, the result of an examination of the casting core, indicates that this was mainly composed of resin.

The final sections are devoted to "Foreign Influence" and "Asiatic Influence?" On the latter point Stone lists nine "details connected with the art of casting which appeared in Asia much earlier than in America," and 11 "decorative elements and artifacts of metal which are found in both Asia and America." She suggests that heat-working of gold might have been introduced from Asia, possibly about 700 B.C. She concludes that "taken one by one, any one of these items could have been invented independently. Occurring together, however, and associated as they are with the complex of metalwork, the likelihood of their being historically related is greatly increased." With this conclusion I agree.

J. ALDEN MASON
University Museum
Philadelphia, Pa.

One Fold and One Shepherd. Thomas Stuart Ferguson. Books of California, San Francisco, 1958. 405 pp., 144 illus., 4 pls., maps, tables. $6.00.

Ferguson is President of the New World Archaeological Foundation, an institution founded by him which is now undertaking large-scale excavations of great importance at Chiapa de Corzo and other early sites in the state of Chiapas. The very scope of the project is a fitting tribute to the energy and purpose of its originator. One of the richest and fullest stratigraphic sequences yet known for the Formative in Middle America has been outlined by the archaeologists of the Foundation; it is a sequence which is bound to change many of our ideas about Formative sequences elsewhere. I have found material from my excavations on the Pacific coast of Guatemala which is very closely connected with the cultural succession at Chiapa de Corzo.

The Foundation's work has suffered so far from a lack of publication, with the exception of two brief and not very informative summaries of field activities and the excellent and important study by Keith Dixon of the two earliest phases at Chiapa de Corzo. The reviewer's hopes that Ferguson's new book would provide further data on the Chiapas Formative have been sadly shattered by a fairly close reading of the text. The radiocarbon dates for Chiapa de Corzo, already given by Dixon, are here presented in terms of the phases outlined by Gareth Lowe (Chiapa I for Dixon's "Pit 50 Period," Chiapa II for the "Pit 38 Period," and so forth). Other than these dates and a few illustrations (some in color) of the Chiapa de Corzo and Santa Rosa finds, there is frankly little of interest in this work for the non-Mormon archaeologist.

The Book of Mormon describes the migration of various tribes from the Near East across the sea to a new land. *One Fold and One Shepherd* is an argument in legalistic form (illustrations are referred to throughout as "exhibits") for the identification of this new land as pre-Columbian Middle America, a thesis which was put forward by Joseph Smith himself after a reading of John Lloyd Stephens. Relying on a vast quantity of archaeological and documentary data, some sound, some poor, and some really unreliable, Ferguson concludes that there is incontrovertible evidence of influences from Palestine and the Near East on Formative cultures in Middle America. A major "fact" utilized is a cylinder seal from Chiapa de Corzo described on pages 22–3 which, according to a partially quoted letter from William F. Albright, contains "several clearly recognizable Egyptian hieroglyphs." On page 25, following a brief allusion to differences of opinion among Egyptologists concerning the seal, this identification is referred to as "Dr. Albright's first reaction," suggesting the possibility that Albright had changed his mind. The same scholar is quoted as suggesting a resemblance of another Chiapa de Corzo pottery seal to Mesopotamian seals of around 3000 B.C. Here one can only say that the word "seal" as applied to pottery rollers or stamps in Middle America is a misnomer, for they were never used like those of Mesopotamia and Egypt to seal anything, but probably were employed to stamp designs in paint on the human body and perhaps on textiles. A large part of this volume is devoted to Ferguson's major thesis, that Jesus Christ was also the Messiah of Middle America, appearing there in the guise of Quetzalcoatl.

One Fold and One Shepherd, therefore, has value as a statement of the author's beliefs as a Mormon and throws interesting light on why the Grijalva drainage in Chiapas was chosen as the focal point for the program of the New World Archaeological Foundation. Although this book is a thoroughly unscientific polemic and is peppered with typographical errors, archaeologists may want to look at the pictures.

Michael D. Coe
University of Tennessee
Knoxville, Tenn.

NOMINATING COMMITTEE FOR 1959–60

Article II, Section 2 of the By-Laws requires the publication of the following information:

1. Names and addresses of the members of the 1959–60 Nominating Committee: Watson Smith (Chairman), 5045 East Grant Road, Tucson, Arizona; J. L. Giddings, Brown University, Providence 12, Rhode Island; C. R. McGimsey, Museum, University of Arkansas, Fayetteville, Arkansas.

2. List of offices for which nominations will be made: President-Elect (one-year term, will serve as President in 1961–62); Secretary (four-year term); two members of the Executive Committee (two-year terms).

3. Reminder that members may suggest the names of candidates for these offices to the Nominating Committee before December 1, 1959.

ANNUAL MEETING OF THE SOCIETY FOR AMERICAN ARCHAEOLOGY, 1959

The 24th Annual Meeting of the Society for American Archaeology was held on Thursday, Friday, and Saturday, April 30, May 1, and 2 on the campus of the University of Utah, Salt Lake City.

Meeting of the Executive Committee

As required by Article VI, Section 3, of the Society's Constitution, the annual meeting of the Executive Committee was held prior to the annual business meeting of the Society. An account of this meeting is included in the report of the Secretary.

Annual Business Meeting

The annual business meeting was called to order by President Richard B. Woodbury at 7:05 P.M. on Friday, May 1, 1959. Approximately 70 members were present during the business session.

The minutes of the 23rd Annual Meeting were approved as published in American Antiquity, Vol. 24, No. 2, pp. 215–21 (October, 1958).

The reports of the Secretary, Treasurer, and Editor (all printed below) were read and accepted by the membership.

The Elections Committee (David A. Baerreis, Chester S. Chard, William S. Laughlin) reported the results of the mail ballot (444 ballots received) as:

President: Jesse D. Jennings

President-Elect: Erik K. Reed

Vice-President: Robert F. Heizer

Members of the Executive Committee (to 1961):
William R. Coe, Robert H. Lister.

New Business

The following resolution was presented by John C. McGregor and approved by the members:

In recognition of the quarter-century of inquiry and vigorous research sponsored by the Tree-Ring Society, and of the contribution by members of the Society in the application of tree-ring research in the fields of climatology, hydrology, and especially the dating of prehistoric sites: be it resolved that the future development of tree-ring research be supported and encouraged in spirit, by the Society for American Archaeology, and in substance by whatever means may be available.

Considerable discussion was given to the need to give precedence to the business meeting as one of the major sessions of the Society. Avoiding conflicts of time and having adequate time would permit the members to take a greater part in the business affairs of the Society.

The following resolutions were presented by the Committee on Resolutions (Emil W. Haury, Henry Hamilton) and accepted by the membership:

Be it resolved: That the Society for American Archaeology, through its membership, expresses gratitude and appreciation to: (1) the University of Utah and A. Ray Olpin, its President, for having acted so graciously and hospitably as host for the 24th Annual Meeting; (2) Jesse D. Jennings and his colleagues in the Department of Anthropology for the effective and thoughful organization of all aspects of the meeting which insured its success; and, (3) the University of Utah Press and its director, Philip C. Sturges, for both printing and mailing the program, for sponsoring a luncheon for those formally attending the meeting, and for holding open house at the University of Utah Press.

Be it further resolved: That the Society for American Archaeology recognizes, with regret, the loss of the following members during the year by death: Everett J. Case, B. E. McCown, T. B. Noble, Stuart Peck, Claude U. Stone, John R. Swanton, Ernest W. Young.

The annual business meeting adjourned at 7:52 P.M.

Annual Dinner

The annual dinner was held on April 30 at the Hotel Utah at 7:00 P.M. Richard B. Woodbury presided and Jesse D. Jennings spoke in conjunction with the presentation of a movie "Glen Canyon Archeology: II."

Other Sessions

Thursday, April 30:

Developments in Dating Techniques. Session dedicated to Nels C. Nelson, and sponsored jointly with the Tree-Ring Society. Richard B. Woodbury, Chairman.

1. Richard B. Woodbury: Nels C. Nelson and Chronological Archaeology.
2. Bryant Bannister: The Classification and Application of Archaeological Dating Methods.
3. Robert L. Stephenson: The Missouri Basin Chronology Program.
4. Bryant Bannister: The Current State of Tree-Ring Research: An Appraisal.
5. Charles W. Ferguson, Jr.: Big Sagebrush and Other Woody Desert Plants as Possible Tools in Archaeological Dating.
6. Robert E. Bell: Dendrochronology in New Zealand.
7. Frederick Johnson: Errors in Radiocarbon Dates.
8. Paul S. Martin: Postglacial Pollen Sequence and the Cochise Culture of Southern Arizona.
9. Dick Shutler, Jr.: Current Status of Carbon-14 Dating in Western North America.
10. Jim J. Hester: Late Pleistocene Faunal Extinction and Radiocarbon Dating.
11. George C. Kennedy: The Application of Thermoluminescence to Problems in Archaeology.
12. John N. Rosholt: Investigation of a Pleistocene Dating Method Using Uranium and Its Radioactive Daughter Products.
13. Alex D. Krieger: Evaluation of Evidence for Pleistocene Man in America.

Friday, May 1, forenoon:

General Papers on Archaeology. Erik K. Reed, Chairman.

1. John L. Champe and Charles H. McNutt: Can Paraffin be Removed from Charcoal Samples?
2. Harriett Ezra and Sheilagh Brooks: Histological Identification of Human Bones.

3. Carl B. Compton: Some Observations on the Weeping Eye Motif and Its Distribution.

4. David Gebhard: Technical Aspects of Art Criticism as Illustrated in the Prehistoric Pictographs of the Lower Pecos Area.

5. Elmer R. Smith: Water, Food and Settlement.

6. Robert E. Bell: A Fluted Point Site in South America.

7. William M. Harrison: An Experiment in Archaeological Method.

8. Carling Malouf: The Principle of Emanation and Its Application to Historic Reconstruction.

Historic Archaeology and Linguistics and Archaeology. Charles Di Peso, Chairman.

1. Carlyle S. Smith: The Characteristics of French Gun Flints.

2. Melvin L. Fowler: Ecological Interpretations of Archaeological Site Data: Modoc Rock Shelter.

3. John L. Cotter: The Nurture, Development and Career of the Historical Archaeologist.

4. Allan H. Smith: The David Thompson Journals of 1809-1812 as an Example of Archaeological Resource Material.

5. Arthur J. O. Anderson: Goldcasting Terms Used by Sahagún's Informants.

6. Georg K. Neumann: Race, Language, and Culture in Aboriginal North America.

7. Walter W. Taylor: The Desert Cultures and Hokan-Siouan.

8. Kimball Romney: Archaeological Leads in Linguistic Materials: Examples from Uto-Aztecan.

Friday, May 1, afternoon:

Archaeological Theory and Method. Emil Haury, Chairman.

1. John M. Goggin: Underwater Archaeology: Its Nature, Uses, and Limitations.

2. Tom O. Miller, Jr.: Statistical Techniques for Handling Quantities of Variable Projectile Points: Test Case, Northern Idaho.

3. Alan P. Olson: Systematics and Settlement Pattern.

4. Albert C. Spaulding: The Dimensions of Archaeology.

5. Irving Rouse: The Classification of Artifacts in Archaeology.

6. James C. Gifford: Ceramic Classifications as Indicators of Cultural Phenomena.

Salvage Archaeology. Joe Ben Wheat, Chairman.

1. Robert L. Stephenson: River Basin Salvage Problems Today.

2. Fred Wendorf and Spike Keller: Highway Salvage.

3. Edward B. Jelks: Salvage Archaeology in Texas.

4. Earl H. Swanson: Archaeological Exploration in Central and Southern Idaho — 1958.

5. Dee C. Taylor: Salvage Archaeology in Badlands National Monument, South Dakota.

6. Henry W. Hamilton: Current Work of the Committee for Recovery of Archaeological Remains.

7. George A. Agogino: Brief Comments Regarding Salvage Archaeology at Military Maximum Security Bases.

Friday, May 1, evening:

Old World Prehistory Relevant to the New World. Charlie R. Steen, Chairman.

1. Ralph Solecki: Solutrean and Sandia — Diffusion, Parallelism, or Imagination (read by Waldo R. Wedel).

2. Chester S. Chard: Neolithic Culture Areas of Northern Asia: A Preliminary Definition.

Arid Lands Problems. Fred Wendorf, Chairman.

1. Richard B. Woodbury: The Role of Archaeology in Arid Lands Research.

2. F. E. Green and Fred Wendorf: Ecological Studies of Late Quaternary Deposits on th. Southern High Plains.

3. Maurice E. Cooley: Alluvial Geology and Hydrology in Glen and San Juan Canyons, Utah and Arizona.

Saturday, May 2:

Archaeology of Mesoamerica and the Southwest. J. Charles Kelley, Chairman.

1. J. Charles Kelley: Probable Mesoamerican Sources for Certain Southwestern Cultural Developments.

2. William W. Wasley: A Hohokam Platform Mound near Gila Bend, Arizona.

3. Charles C. Di Peso: Preliminary Report on the Excavations at Casas Grandes.

4. Richard H. Brooks: Comments on the Physical Limits of Some Features of Southwestern Cultures in Northern Mexico.

5. Bertha P. Dutton: Mesoamerican Ball Courts.

6. Walter W. Taylor: Tetavejo, A Cave in Sonora.

7. C. W. Meighan: Recent Developments in West Mexican Archaeology.

8. H. B. Nicholson: Archaeological Investigations in the Sierra de Tamaulipas, Tamaulipas State, Mexico.

9. Richard S. MacNeish: Domesticated Plants from Prehistoric Tamaulipas and Their Cultural Implications.

10. William J. Mayer-Oakes: A Developmental Concept of Pre-Spanish Urbanization in the Valley of Mexico.

11. Heath-Jones: Definition of an Ancestral Maya Civilization in Miraflores Phase: Kaminaljuyú.

12. Suzanne W. Miles: Some Related Early Sculptures from the Guatemalan Highlands and Pacific Slope.

13. Gareth W. Lowe: The Long Sequence of Preclassic Architectural Development at Chiapa de Corzo, Chiapas.

14. Bruce W. Warren: Monte Albán, Tres Zapotes, La Venta, Uaxactún and Yucatán in Light of the Third Horizon at Chiapa de Corzo (read by John L. Sorenson).

15. Jeremiah F. Epstein: A Ceramic Sequence for Northeastern Honduras.

Archaeology of Central United States and South America. Arnold Withers, Chairman.

1. Ellis Crawford: The Rogers Site and Its Relation to Adena and Hopewell.

2. Emily J. Blasingham: Preliminary Report on the Archaeology of the Saline Springs Site, Gallatin County, Illinois.

3. W. Raymond Wood: Afton Points in the Ozark Highlands — Context and Comments.

4. W. D. Frankforter and George A. Agogino: Recent Preceramic Archaeological Developments in Western Iowa.

5. James B. Shaeffer: Archaeology of the Fort Sill Military Reservation, Oklahoma.

6. Richard Page Wheeler: The Middle Prehistoric Period in the Central and Northern Plains.

7. John J. Hoffman: A Preliminary Archaeological Survey of Yellowstone National Park.

8. Joe Ben Wheat: The Olson-Chubbock Site: A Paleo-Indian Bison Killsite.

9. Charlie R. Steen: The Pigeon Cliffs Site, Union County, New Mexico.

10. Arthur J. Jelinek: Archaeological Materials from the Middle Pecos River Valley, New Mexico.

11. Douglas Osborne: Wetherill Mesa Archaeological Project.

12. J. M. Cruxent and Irving Rouse: Historic Site Archaeology in Venezuela.

13. Vera Birrell: The Formative Stage in Peru in the Sphere of American Archaeology.

14. Edward P. Lanning: A New View of the Early Pottery Periods of the Peruvian Coast.

15. Rosa Fung de Lanning: Excavations in the Rockshelter of Callavallauri, Huancayo, Peru.

Archaeology of Western North America. Robert Heizer, Chairman.

1. Charles E. Borden: Labrets in Western North America, Eskimo or Indian?

2. J. L. Giddings: Beach Ridge Dating in Alaska.

3. Douglas Osborne: Excavations in Grand Coulee, Washington.

4. Robert E. Greengo: Recent Excavation in the Middle Columbia Valley.

5. Richard D. Daugherty: A Tentative Cultural Sequence for the Lower Snake River Region.

6. James T. Davis: Further Notes on Figurines in the Western United States.

7. Ruth D. Simpson: Archaeological Survey of Pleistocene Manix Lake Basin.

8. Robert F. Heizer: Some Stratified Sites and Projectile Point Sequences in Nevada.

9. A. B. Elsasser: Further Data on the Martis Complex in California and Nevada.

10. Edward P. Lanning: An Archaeological Sequence for the Owen's Lake Region, California.

11. Eugene R. Prince: Great Basin Pottery.

12. William C. Massey: The Pinto-Gypsum Complex in Baja California (read by Donald R. Tuohy).

13. David A. Breternitz: Archaeological Sequence in the Verde Valley, Arizona.

14. Alfred E. Dittert, Jr.: Problems Concerning the Sequence of Occupation in the Upper San Juan River District.

15. Elizabeth Ann Morris: A Pueblo I Site Near Bennett's Peak, Northwestern New Mexico (read by Alan P. Olson).

Report of the Secretary

Committees. The following regular committees were appointed by President Richard B. Woodbury and approved or elected by the Executive Committee as required by the Constitution and By-Laws of the Society.

Nominating Committee: Robert Wauchope (Chairman), Glenn Black, and Gordon Ekholm.

Viking Fund Award Committee: Albert C. Spaulding (Chairman), John M. Corbett, E. Mott Davis, James B. Griffin, Emil W. Haury, J. Charles Kelley, Alex D. Krieger, Betty J. Meggers, and Gordon R. Willey.

Program Committee: James H. Gunnerson (Chairman), Terah L. Smiley, Albert C. Spaulding, and Dee Ann Suhm.

Local Arrangements Committee: Dee Ann Suhm (Chairman), and William D. Lipe.

Elections Committee: David A. Baerreis (Chairman), Chester S. Chard, and William S. Laughlin.

Resolutions Committee: Emil W. Haury and Henry Hamilton.

Frederick Johnson (Chairman), Irving Rouse and Watson Smith were named members of a committee to study the question of constitutional revision. The report of the committee was presented by the chairman to the Excutive Committee which transmitted it for consideration to the incoming Executive Committee and commended and discharged the committee.

Richard B. Woodbury (Chairman, *ex officio*), Raymond H. Thompson (*ex officio*), Glenn A. Black, John L. Cotter, Edward B. Jelks, and Frank J. Soday were named members of a committee to consider the possibility of the Society preparing, sponsoring, or assisting in the development of a manual of archaeological methods. The committee reported that the handbook to be published by the Texas Archeological Society may serve the needs visualized and recommended deferring further action until this study appeared. The committee was discharged.

A committee composed of David A. Baerreis and Raymond H. Thompson was instructed to investigate the desirability of the Society joining in the sponsorship of a publication series on microcard. The response to inquiries indicated that a sufficient number of the members favored and would make use of such a series to warrant its development. Editor Raymond H. Thompson was authorized to proceed with the project.

J. Charles Kelley was appointed representative to the council of the American Association for the Advancement of Science. Albert C. Spaulding was appointed representative to the Pan-African Congress to be held at Leopoldville, Belgian Congo.

Jesse D. Jennings was chosen by the Viking Fund Award Committee as the 1958 medalist.

The Nominating Committee presented the following names for the 1959 election of officers: For President, Jesse D. Jennings and Albert C. Spaulding; for President-Elect, Donald Collier and Erik K. Reed; for Vice-President, John L. Champe and Robert F. Heizer; for first Executive Committee member (to 1961), Charles C. Di Peso and Robert H. Lister; and, for Second Executive Committee member (to 1961), William R. Coe and Robert L. Rands.

The Executive Committee held a special meeting at Norman, Oklahoma, on May 2, 1958 and its regular meeting in Salt Lake City, Utah, on April 30, 1959. Its actions during the fiscal year (other than approval of the appointments and committee actions noted above) include approval of the dates of May 5, 6, and 7 for the 1960 annual meeting of the Society at New Haven, Connecticut and established a $2.00 registration fee for this meeting. It accepted the invitation of the Ohio State Museum to hold the 1961 annual meeting at Columbus, Ohio. The Executive Committee approved the Editor's, Treasurer's and Secretary's reports for 1958–59 and the proposed budget for 1959–60 prepared by the Treasurer.

A proposal to initiate an abstract series with funds provided by the Charles F. Brush Foundation in the amount of $10,000 for three years was brought to the Executive Committee. Raymond H. Thompson and Richard B. Woodbury were authorized to explore whether adequate volunteer help would be obtained to carry out the abstracting, and if adequate help could be obtained they were authorized to proceed with the project and the Society to accept the gift.

Respectfully submitted,
David A. Baerreis, *Secretary*

Report of the Editor

During 1958–59 the Society published Volume 24 of American Antiquity and Number 16 of its *Memoirs* series. There are 460 pages in Volume 24, 66% of which are devoted to 24 major articles, 7.5% to 23 shorter contributions in the Facts and Comments sections, and 12% to 58 reviews. In addition the volume contains one obituary, 39 pages of Notes and News, Some Recent Publications, the report of the 23rd Annual Meeting, sev-

eral announcements and notices, and an index. Memoir 16 is a 213-page monograph whose author is a non-professional. A major share of the cost of this study of a protohistoric Caddoan site was contributed by several firms and individuals in Shreveport, Louisiana. The editor expresses appreciation for this generous support.

The increasing production of large numbers of manuscripts on American archaeology which are of publishable quality constitutes the major editorial problem at the present time. The 111 manuscripts submitted during the past year are a substantial increase over the number received by the editor in the previous year. Four of the five manuscripts of memoir length have been accepted for publication and financial support is assured for two of them. Of the 49 article-length manuscripts, 32 have been accepted and five are pending revisions. The majority of the manuscripts submitted are shorter contributions; 34 of 56 received have been accepted. It is possible to reduce the inevitably long delay in the publication of these shorter papers if authors will submit more of them to the editors of the growing number of excellent regional journals. The editor has attempted to assist authors in placing publishable manuscripts in these journals. In summary, 76 manuscripts, approximately 65% of the 111 received, were accepted and 34 rejected.

The over-all problem of an enormous and growing backlog of unpublished manuscripts, which in turn results in an unfortunately long lag between receipt and publication, remains largely unsolved. However, plans have been made to increase the size of AMERICAN ANTIQUITY by adding more pages to each issue. It is hoped that this increase will alleviate the situation somewhat in the near future. Other plans for the coming year include the expansion of the program of publishing translations and abstracts of Russian archaeological material, the development of an abstract series for New World archaeology, and the preparation of a cumulative index for the first 25 volumes of AMERICAN ANTIQUITY.

Respectfully submitted,
RAYMOND H. THOMPSON, *Editor*

REPORT OF THE TREASURER

General. At the 1958 Annual Meeting, the Executive Committee instructed the Treasurer to retain a Certified Public Accountant to audit the accounts of the Society and to advise on accounting procedures. The 1958–59 statement was prepared by the firm of Ernst & Ernst, Accountants–Auditors. Recommendations concerning accounting procedures have been installed.

Finances. As the accompanying Statements from Ernst & Ernst indicate, the Society is in sound financial condition.

Membership. The following totals are reported by the Executive Secretary of the American Anthropological Association as the Society membership, April 15, 1959:

Individual	1112
Life	10
Institutional	346
Exchange and Complimentary	4
Total	1472

These figures represent a net increase of 88 over the 1958 membership. There are 59 more individual memberships, 25 institutional, and four exchange.

BALANCE SHEET*

April 15, 1959

Assets

Current Assets	
Cash in Bank, Operating Fund, Checking Account	$3,338.65
Publication Fund, Savings Account	8,913.27
Permanent Fund, Savings Account	717.39
Estimated Accounts Receivable, Operating Fund	1,195.20†
Estimated Accounts Receivable, Publication Fund	465.79†
	$14,630.30

Liabilities

Publishing costs, Memoir 16, estimate	$ 5,200.00
NET WORTH	$ 9,430.30
	$14,630.30

REPORT OF ERNST & ERNST

Executive Committee
Society for American Archaeology
Pittsburgh, Pa.

We have examined the statements of receipts, expenditures, and assets of the Operating Fund, the Publication Fund and the Permanent Fund, of the Society for American Archaeology for the year ended April 15, 1959. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying statements of receipts, expenditures, and assets present fairly a summary of the recorded receipts and expenditures of the Operating Fund, the Publication Fund and the Permanent Fund of the Society for American Archaeology for the year ended April 15, 1959, and the assets of the Funds at April 15, 1959 arising from such cash transactions.

ERNST & ERNST
Certified Public Accountants

Pittsburgh, Pa.
April 22, 1959

* Summarization and compilation of Ernst & Ernst Statements which follow.

† As reported by the Executive Secretary, American Anthropological Association.

STATEMENT OF RECEIPTS, EXPENDITURES, AND ASSETS

Year ended April 15, 1959

OPERATING FUND

Receipts				
Dues				$12,233.72
Publication receipts				807.70
TOTAL RECEIPTS				$13,041.42
Expenditures				
Publishing AMERICA ANTIQUITY				
Printing		$ 6,272.05		
Illustrating		1,029.57		
Reprints		921.72		
Distribution		621.09		
Editing				
Editor's office	$ 424.96			
Editorial assistant	1,000.00			
Associate Editor's office	52.40	1,477.36	$10,321.79	
Society officers' expense				
President's office		$ 25.95		
Secretary's office		247.14		
Treasurer's office				
Dues collection	$ 748.00			
Miscellaneous	125.75	873.75	1,146.84	
Annual meeting expense				
Expense allowances		$ 100.00		
Miscellaneous		90.25	190.25	
Miscellaneous			2.33	
			$11,661.21	
Transfers to Publication Fund — net			1,411.00	
TOTAL EXPENDITURES				13,072.21
EXCESS OF EXPENDITURES OVER RECEIPTS				$ 30.79
Cash balance at April 15, 1958				3,369.44
CASH BALANCE APRIL 15, 1959				$ 3,338.65
Accounts receivable at April 15, 1959				1,195.20
ASSETS AT APRIL 15, 1959				$ 4,533.85

STATEMENT OF RECEIPTS, EXPENDITURES, AND ASSETS

Year ended April 15, 1959

Publication Fund

Receipts		
Sales of publications		$ 1,969.33
Interest		141.94
Gifts for publication of Memoir 16		
United Gas Corpation	$ 1,000.00	
First National Bank, Shreveport, La.	250.00	
Southwestern Electric Power Company	250.00	
Clarence H. Webb	160.00	
Bayou State Oil Corporation	150.00	
Paul M. Brown	100.00	
		1,910.00
		$ 4,021.27
Transfers from the Operating Fund		1,411.00
Total Receipts		$ 5,432.27
Expenditures		
Publishing Memoir 15	$ 1,699.37	
Distribution	227.67	
Total Expenditures		1,927.04
Excess of Receipts over Expenditures		$ 3,505.23
Cash balance at April 15, 1958		5,408.04
Cash Balance April 15, 1959		$ 8,913.27
Accounts receivable at April 15, 1959		465.79
Assets at April 15, 1959		$ 9,379.06

Note A. At April 15, 1959, the Society had not been invoiced for publishing costs, amounting to approximately $5,200.00, in connection with Memoir 16.

Permanent Fund

Interest received (no expenditures during the year)	$ 17.58
Cash balance as of April 15, 1958	699.81
Assets (cash) at April 15, 1959	$ 717.39

BUDGET FOR 1959–60

Receipts — OPERATING FUND

Dues, 1959–60			$12,200.00	
Authors' charges, reprints			1,400.00	
Authors' charges, excess engravings			250.00	
Cash Reserve, April 15, 1959			3,338.65	$17,188.65

Expenditures

Publishing AMERICAN ANTIQUITY				
Printing	$ 7,600.00			
Illustrating	1,200.00			
Distribution	600.00			
Reprints	1,100.00	$10,500.00		
Editing				
Editor's Office	525.00			
Associate Editors' Offices	75.00			
Editorial Assistant	900.00	1,500.00	$12,000.00	
Society Officers' Expenses				
President's Office		100.00		
Secretary's Office		250.00		
Treasurer's Office				
Routine	200.00			
Dues collection charges	762.50			
Auditing, 1958–1959	100.00	1,062.50	1,412.50	
Annual Meeting Expenses				
Routine	150.00			
Officers' expense allowance	250.00		400.00	
EXCESS OF RECEIPTS OVER EXPENDITURES, April 15, 1960			$ 3,576.15	

PERMANENT FUND

Interest (no expenditures expected)			$ 18.02	
Cash Reserve at April 15, 1959			717.39	
Cash Reserve at April 15, 1960			735.41	

Receipts — PUBLICATION FUND

Sale of back issues, AMERICAN ANTIQUITY		$ 900.00		
Sale of Memoirs		500.00		
Interest		100.00	$ 1,500.00	
Cash Reserve at April 15, 1959			8,813.27	$10,413.27

Expenditures

Publishing, Editorial Assistant, Memoir 16			5,200.00	
Distribution, Memoir 16			75.00	
Distribution, back issue sales			390.00	5,665.00
EXCESS OF RECEIPTS OVER EXPENDITURES at April 15, 1960				$ 4,748.27

Respectfully submitted, JAMES L. SWAUGER, *Treasurer*

CONSTITUTION AND BY-LAWS OF THE SOCIETY FOR AMERICAN ARCHAEOLOGY

CONSTITUTION

Article I — Name

The name of this organization shall be the Society for American Archaeology.

Article II — Objects

Section 1. The objects of the Society shall be to promote and to stimulate interest and research in the archaeology of the American continents; to encourage a more rational public appreciation of the aims and limitations of archaeological research; to serve as a bond among those interested in American Archaeology, both professionals and non-professionals, and to aid in directing their efforts into more scientific channels; to publish and to encourage the publication of their results; to foster the formation and welfare of local archaeological societies; to advocate and to aid in the conservation of archaeological data; and to discourage commercialism in the archaeological field and to work for its elimination.

Section 2. The practice of collecting, hoarding, exchanging, buying, or selling archaeological materials for the sole purpose of personal satisfaction or financial gain, and the indiscriminate excavation of archaeological sites are declared contrary to the ideals and objects of the Society.

Article III — Powers

Section 1. The Society shall have the power to receive, administer, and disburse dues, assessments, and other grants to further its ends; to acquire, hold absolutely or in trust for the purposes of the Society, and to convey property, real and personal; to publish reports, bulletins, journals, and monographs; to affiliate with other organizations in the pursuit of common aims, and to appoint delegates or representatives to such organizations; to establish branches, sections, or divisions, on a regional or functional basis; and to engage in such other activites as are in keeping with the objects of the Society.

Article IV — Membership

Section 1. The membership of the Society shall consist of two classes: Active Members and Benefactors. Dues in the Society shall be fixed by the Executive Committee. Spouses of Active Members may become Active Members upon subscription to the objects of the Society and upon payment of special dues to be determined by the Executive Committee.

Section 2. Any person in sympathy with the objects of the Society may be elected to Active Membership. He shall give written subscription to the ideals, objects, and accepted standards of the Society.

Section 3. Residents of any country are eligible for membership.

Section 4. The Society shall not approve of applications for membership from persons who habitually misuse archaeological materials or sites for commercial purposes or who violate accepted standards of professional ethics.

Section 5. The Executive Committee may, by three-quarters vote, remove from the membership rolls any member whose acts are contrary to the ideals, objects, and accepted standards of the Society as set forth in Article II and Article IV, Section 4, or who otherwise makes improper use of his membership. The action of the Executive Committee may be subject to an appeal to the Society at its Annual Meeting.

Article V — Organization

Section 1. The officers of the Society shall consist of a President, a President-Elect, a Secretary, a Treasurer, an Editor, and four members of an Executive Committee. Provided that the Vice-President elected at the Annual Meeting, May 1, 1959, shall serve in that office and as a member of the Executive Committee for one year.

Section 2. The Executive Committee shall consist of the President, the President-Elect, the Secretary, the Treasurer, the Editor, and four members elected from the membership.

Section 3. The President-Elect shall serve for one year and shall advance to the office of President in the year following his election to office. The Secretary, Treasurer, and Editor shall be elected for terms of four years. The members of the Executive Committee shall serve for terms of two years.

Section 4. No officer of the Society shall be eligible for re-election to the same office until Annual Meeting next following that at which his term of office shall have expired.

Section 5. Subject to general directives and limitations imposed by the membership at the Annual Meeting, any Special Meeting, or by mail ballot, the Executive Committee shall have authority to execute on behalf of the Society all powers and functions of the Society, as defined in this Constitution and in the By-Laws.

Section 6. The President shall be the presiding officer of the Society and Chairman of the Executive Committee, he shall have the usual appointive powers and he shall exercise all the duties and responsibilities commonly associated with this office, except as provided in this Constitution and in the By-Laws.

Section 7. The President-Elect shall assume the duties of the President in the event of the absence, death, resignation, or incapacity of the President.

Section 8. In the event of a vacancy in any elective office, other than that of the President, the Executive Committee shall have the power to make interim appointment to the office. This appointment shall terminate

at the next Annual Meeting. The office shall be filled by election at the next Annual election or by election at the Annual Meeting of the Society.

Section 9. The Secretary, subject to the directives of the Executive Committee, shall maintain the central office of the Society, have charge of administrative matters under the direction of the President, serve as Secretary to the Executive Committee, and otherwise discharge the duties commonly associated with his office, subject to provisions in the Constitution and By-Laws.

Section 10. The Treasurer shall administer the finances of the Society subject to budgetary and other regulations imposed by the Executive Committee and he shall discharge such other duties as are commonly associated with his office, subject to provisions in the Constitution and By-Laws.

Section 11. The Editor shall have full charge of the publications of the Society under the direction of the Executive Committee and any provisions of the Constitution and By-Laws.

Section 12. An Auditing Committee consisting of three Active Members who are not officers of the Society shall be elected by the Annual Meeting of the Society. This Committee shall make an annual audit of the books of the Society and report to the next Annual Meeting. A digest of its report may be submitted to the Executive Committee.

Article VI — Meetings

Section 1. The Society shall hold an Annual Meeting at a time and place to be designated by the Executive Committee. The attending members shall constitute a quorum. At this meeting the business of the Society shall be transacted, archaeological papers and other matters of scientific interest presented, and symposia and discussions may be held.

Section 2. Special Meetings shall be called by the President at any time at the direction of the Executive Committee. Any matter of business may be decided at a Special Meeting provided notice of such business is specified in the call. Joint or Regional Meetings for the purpose of discussing archaeological problems, symposia, and matters of mutual interest among scientists may be called by the President at any time, and shall be called by him upon direction by the Executive Committee.

Section 3. An annual meeting of the Executive Committee shall be held before the Annual Meeting of the Society. Special meetings of the Executive Committee may be held at the call of the President. The President shall call a special meeting of the Executive Committee at any time upon the written demand of at least three members thereof.

Section 4. All matters of business of the Society may be decided by means of a referendum vote by mail ballot under conditions specified in the By-Laws.

Article VII — Amendments

Section 1. This constitution may be amended by a two-thirds vote of the members present at an Annual Meeting or a Special Meeting. The Constitution may also be amended by mail ballot provided that a proposed amendment is approved by two-thirds of the votes cast.

Section 2. Amendments may be proposed by the Executive Committee or by any ten members of the Society. The proposed amendments shall be mailed to the members of the Society by the Secretary at least thirty days before the Annual Meeting or Special Meeting. In the case of a mail ballot upon an amendment, members shall address ballots to the Secretary and place them in the mail not more than thirty days from the date they were mailed out by the Secretary. An amendment shall go into effect immediately upon approval unless otherwise specifically provided.

Section 3. The amendment and provisions of this Constitution, as approved by mail ballot on October 5, 1959, shall be effective immediately upon its adoption and shall supersede and nullify all previous constitutional enactments in conflict with them and all amendments and provisions not mentioned herein. The officers elected at the Annual Meeting on May 1, 1959, shall complete their terms without required re-election.

BY-LAWS

Article I — Membership

Section 1. Applications for membership in the Society shall be submitted to the Secretary. They shall state the business or professional connections of the applicant and the nature of his interest in American archaeology. Applicants shall be considered subscribers upon payment of the required fee and until elected to membership. The Secretary, acting as the agent of the Society, shall elect or reject applicants for membership. In arriving at his decision he may consult the members designated by the President under the provisions of Article III, Section 1, of these By-Laws. In the event an applicant for membership is rejected he, or three members acting for him, may appeal to the Executive Committee whose decision shall be final.

Section 2. Annual dues of Active Members shall be fixed by the Executive Committee.

Section 3. Any person in sympathy with the objects of the Society may become a Benefactor by the payment at one time of $500.00 or more.

Section 4. Each Active Member shall receive all the Society's regular publications for the fiscal year covered by his dues and shall have one vote in the transaction of the business of the Society. He shall be eligible for any elective or appointive office in the Society, subject only to restrictions defined elsewhere in the Constitution and

By-Laws. No member who as spouse of another member pays less than the full amount in the form of special dues shall receive any of the Society's publications except on payment therefor of the difference between his reduced dues and the full amount of dues.

Section 5. Life Members, as of May 1947, and Benefactors shall have during their lives all the privileges of Active Membership but shall be exempt from the payment of dues.

Section 6. Any library, museum, university, school, or other institution may subscribe to the publications of the Society without privilege of membership. The annual cost of subscriptions shall be fixed by the Executive Committee.

Article II — Elections

Section 1. Before June 30th of each year the President shall submit a list of at least six names to the Executive Committee. From this list the Executive Committee shall, by preferential voting, elect a Nominating Committee of three.

Section 2. The names of the members of the Nominating Committee and their addresses for any given fiscal year shall appear prominently in the second number of *American Antiquity* for that year. There shall also be a listing of the offices to be vacated for which nominations will be made for the ensuing year with a notice that members may suggest the names of candidates for such offices to the Nominating Committee before December 1. For the offices of Secretary, Treasurer, and Editor the Nominating Committee shall nominate a member candidate. For the other offices the Nominating Committee shall nominate at least two and no more than three member candidates. All prospective nominees must indicate in writing to the Nominating Committee their willingness to serve as an officer of the Society, subject to the provision of the Constitution, Article V, Section 4. The list of nominees shall be mailed to the Secretary before February 1 for distribution to the individual members of the Society in accord with the provisions of Article II, Section 5, of the By-Laws.

Section 3. Before June 30th of each year the President with the advice and consent of the Executive Committee shall appoint a Program Committee. This Committee shall be charged with the responsibility for the scientific program of the ensuing Annual Meeting. The Program Committee shall consult with the Executive Committee concerning the form and general content of the scientific program at the Annual Meeting. Programs for Joint or Regional Meetings shall be the responsibility of the Program Committee or special committees appointed by the President as conditions require.

Section 4. The President shall appoint without review by the Executive Committee, and whenever necessary, two tellers who shall act with the Secretary as an Elections Committee. The Secretary shall be chairman of the Committee. Elections shall be administered by this Committee.

Section 5. Each active member shall be entitled to vote for one candidate for each office. Voting shall be by mail ballot. Ballots shall be mailed to the Active Members by the Secretary at least thirty days before the Annual Meeting. To be counted as votes ballots must be in the hands of the Secretary on or before a date specified by him but not less than ten days before the Annual Meeting. The results of the elections shall be announced by the Elections Committee at the Annual Meeting. The candidate for an office who receives the highest number of votes shall be declared elected to that office. In the event of a tie vote, the Elections Committee shall hold a run-off election at the Annual Meeting.

Article III — Duties of Officers

Section 1. President.

The President may appoint representatives of the Society to other societies, agencies, or councils, or select such representatives from slates submitted by other societies, agencies, or councils.

Acting on the advice and consent of the Executive Committee, the President shall appoint all necessary committees and define their duties.

The President may designate members in various regions to advise the Secretary concerning the qualifications of applicants for membership and concerning the status of archaeological research in the respective regions.

The President and either the Secretary or Treasurer shall sign all written contracts authorized by the Executive Committee, except that basic contracts for printing and other matters necessary to publications shall be signed by the President and the Editor.

The actions of the President in exercising his duties and responsibilities of his office shall be subject to review and approval of the Executive Committee.

Section 2. Secretary.

The Secretary shall maintain the central office of the Society, which shall serve as a clearing house and advisory center on archaeological matters.

The Secretary shall have general charge of administrative matters under the direction of the President; he shall act as Secretary of the Executive Committee; he shall render an annual report to the Executive Committee which upon approval shall be presented to the Annual Meeting and included in the minutes of the meeting; he shall transmit to the Editor all information of general archaeological interest; he may, subject to authorization and budgetary provision by the Executive Committee, employ clerical assistance.

In the event of the absence, death or incapacity of the Treasurer, the Secretary shall have power to receive and disburse funds of the Society. Such powers shall remain in force until a successor to the Treasurer is appointed or elected.

The Secretary shall compile the minutes of Annual, Special, Regional, and Joint Meetings of the Society which shall include the reports of all officers, committees, delegates, and representatives required to make such reports. All such minutes shall form the Annual Report

of the Society which shall be published in *American Antiquity*.

Section 3. Treasurer.

The Treasurer shall administer the finances of the Society subject to budgetary and other regulations approved by the Executive Committee. He shall maintain proper and adequate records which at all times shall be open to inspection of the Executive Committee. At the Annual Meeting of the Executive Committee the Treasurer shall submit a budget for the ensuing year. He shall render an annual report which when approved by the Executive Committee shall be presented to the Annual Meeting for approval.

The Treasurer shall maintain the membership list and provide the mailing list for publications of the Society. He shall have charge of the care and sale of surplus copies of publications. The Treasurer may be required to give bond and may, subject to authorization and budgetary provisions by the Executive Committee, employ clerical assistance and retain the services of a Certified Public Accountant.

Section 4. Editor.

The Editor shall have full charge of all publications of the Society under the direction of the Executive Committee. He may make minor adjustments in basic contracts relating to publication, and he may, subject to approval of the Executive Committee, enter into agreements with individuals and institutions for financing publications. All bills relating to publishing obligations shall be certified to the Treasurer by the Editor. The Editor shall render an annual report to the Executive Committee which upon approval shall be presented to the Annual Meeting.

The Editor may, subject to review by the Executive Committee, appoint Associate and Assistant Editors who shall, as far as practicable, represent the various geographic or cultural areas and fields of interest in American archaeology. The Associate and Assistant Editors shall serve concurrently with, and under the direction of, the Editor and shall be responsible to him. The Editor may, subject to authorization and budgetary provisions by the Executive Committee, employ clerical and editorial assistance.

Section 5. Executive Committee.

The Executive Committee may hold Special Meetings at the call of the President.

Special Meetings of the Executive Committee shall be called by the President at any time upon written demand of at least three members of the Committee.

A Quorum of the Executive Committee shall consist of a majority of its membership.

Questions shall be decided by the Executive Committee by a majority of the votes cast at any meeting or by mail ballot. In case of a tie vote the decision of the President shall be final. If any member of the Executive Committee is unable to attend a meeting he may, by written proxy, appoint an Active Member in his stead. But no person by virtue of holding proxies shall have the right to cast more than one vote.

The President may, on his own initiative, or shall at the written request of any member of the Executive Committee, ask the Committee to vote on specific questions by mail ballot. Ballots shall be mailed by the Secretary who shall specify on the ballots the date on or before which they are to be placed in the mail for return to the Secretary. This date shall be not less than fifteen days or more than thirty days from the date they were placed in the mail by the Secretary.

Reports of officers, representatives, delegates, committees, and agents shall be approved by the Executive Committee. At the discretion of the Executive Committee these reports may be presented in full or in brief form at the Annual Meeting.

The Executive Committee shall act upon the budget provided by the Treasurer. A budget shall be submitted by the Executive Committee to the Annual Meeting for approval.

The Executive Committee may retain the services of an agency to assist the officers in any of their duties.

Branches, sections, or divisions of the Society may be established by vote of the Executive Committee provided that the presiding officer and one half or more of the membership of such an organization shall be and remain members of the Society for American Archaeology.

Article IV — Meetings

Section 1. Due notice of the place and date of the next Annual Meeting and a list of nominees for vacant offices shall be published in *American Antiquity* and/or mailed by the Secretary to all classes of membership at least sixty days in advance of the date of the meeting. In so far as practicable, announcements accompanied by a preliminary program shall be mailed by the Secretary to members at least fourteen days in advance of the meeting. Notices of Special Meetings shall be mailed by the Secretary to members at least thirty days in advance of the meeting. Notice of Regional and Joint Meetings shall be mailed to members as far in advance as practicable.

Article V — Referendum

Section 1. A referendum vote may be held by mail ballot at any time upon the initiation of the Executive Committee or a signed petition to the Executive Committee by any twenty-five members. Ballots shall be mailed to members by the Secretary. In order that they may be counted as votes ballots must be placed in the mail by members and addressed to the Secretary not more than thirty days after the date when they were mailed to members by the Secretary. A majority of votes received during the thirty day period shall constitute the deciding vote. The Secretary shall certify the vote to the Executive Committee.

Article VI — Affiliation

Section 1. Independent societies whose objects are compatible with those of the Society for American Archaeology may affiliate with the Society provided that the proposal to affiliate is accepted by the membership

by vote at an Annual or Special Meeting or by mail ballot.

ARTICLE VII — FINANCES

Section 1. The fiscal year of the Society shall begin April 1.

Section 2. Annual dues shall be payable on May 1. Members 90 days in arrears shall not be entitled to receive the Society's publications or to vote, and those one year in arrears may, after final notification, be dropped from the rolls. Members thus dropped may be reinstated by payment of their arrearages, in which case they shall receive the withheld publications, or they may be reelected.

Section 3. Payments made to establish Life Memberships and Benefactorships, and such other moneys as may from time to time be designated for that purpose, shall constitute a Permanent Fund which shall be invested in the name of the Society. The Executive Committee may direct the transfer of sums of money from the Permanent Fund to the Working Fund provided that the total of the Permanent Fund is never reduced below the total sum of payments of all living Life Members, all Benefactors, and all sums which must remain in the Permanent Fund by conditions under which they may have been received.

Section 4. The Trustees of the Permanent Fund shall consist of two Active Members of the Society and the Treasurer, ex officio. The Trustees shall be appointed by the Executive Committee for terms of eight years.

Section 5. The income from annual dues and from investments and other sources shall constitute the Working Fund, available for operating, publication, and other current expenses consistent with the purposes of the Society as the Executive Committee may direct.

Section 6. No financial obligation in excess of funds available in the treasury shall be assumed by the Executive Committee or by any officer on behalf of the Society except when approved by a two-thirds vote of the membership of the Society present at a regular Annual Meeting or at a Special Meeting; provided that for the purpose of this section, estimated receipts from annual dues and other accounts receivable for the current year may be considered as available funds.

ARTICLE VIII — AMENDMENTS

Section 1. These By-Laws may be amended by a majority vote at an Annual or Special Meeting of the Society, or by mail ballot.

Section 2. The provisions of these By-Laws, as approved by mail ballot on October 5, 1959, shall be effective immediately upon their adoption and shall supersede and nullify all previous enactments in conflict with them. The proceedings at the Annual Meeting, May 1, 1959, shall stand without further confirmation.

REVISION OF THE CONSTITUTION AND BY-LAWS

A. V. Kidder, A. L. Kroeber, and Frank H. H. Roberts, Jr. drew up the original Constitution and By-Laws of the Society for American Archaeology, which were published along with the report of the Organization Meeting and a list of those who signed the Constitution in AMERICAN ANTIQUITY, Volume 1, Number 2, pages 146–51. The first revision was made by the Committee on Constitutional Amendment which consisted of J. Alden Mason, Chairman; A. V. Kidder, W. C. McKern, Archibald Crozier, Maurice Robbins, Frederick Johnson, and Robert H. Merrill. A revised Constitution only was published in AMERICAN ANTIQUITY, Volume 8, Number 2, pages 206–8. In 1947, the Committee to Consider Revision of the Constitution, Frederick Johnson and Watson Smith, presented the version published in AMERICAN ANTIQUITY, Volume 13, Number 2, pages 198–200. This version, as amended, was last published in AMERICAN ANTIQUITY,, Volume 20, Number 2, pages 192–5. The present and third revision (pages 298–302, this issue) was prepared by a committee composed of Frederick Johnson, Chairman; Irving Rouse, and Watson Smith. The membership of the Society for American Archaeology approved this revision by mail ballot, 264 to four.

NOTES AND NEWS

EDITED BY NATHALIE F. S. WOODBURY

GENERAL

Albert C. Spaulding has been appointed Program Director for Anthropology and History and Philosophy of Science in the Office of Social Sciences of the National Science Foundation, Washington, D.C. He is on leave from the University of Michigan for this purpose. The Anthropology Program makes grants for basic research in all fields of anthropology and for travel to international meetings (excluding Mexico and Canada). [See page 272 for announcement of travel grants for the Sixth International Congress of Anthropological and Ethnological Sciences. —Editor]

NORTHWEST

IDAHO. On the basis of extensive surveys carried out in 1958, the Idaho State College Museum set up three field projects for the summer of 1959. Earl Swanson reports that an intensive survey of the Owyhee Desert in southwestern Idaho was begun in May, supported by a grant from the American Philosophical Society. Ruth Gruhn of Harvard University directed an excavation crew in a large lava cave near Dietrich. Field work was begun in June, under a grant from the American Academy of Arts and Sciences to J. O. Brew and with additional support from the Idaho State College Museum. A third field project was conducted along the Snake River plain near American Falls on early types of tools and their relationship to prehistoric climates in the region.

WASHINGTON. During this past summer, crews from Washington State University at Pullman excavated in the Ice Harbor Reservoir area on the lower Snake River and in the Rocky Reach Reservoir on the Columbia River. The annual summer field school in archaeology, with 20 students enrolled, conducted excavations of a burial island and a pit house village on the lower Snake River under the direction of Richard Daugherty with a National Park Service contract. A crew of eight, under the field direction of Roderick Sprague, a graduate student at Washington State University, conducted extensive testing operations at a number of sites in the Rocky Reach Reservoir. This is the first systematic excavation along this stretch of the Columbia and provides interesting material for comparison with archaeologically better known regions.

OREGON. The University of Oregon continued salvage excavations commenced in 1958 in the John Day Reservoir under contract with the National Park Service. David L. Cole was field director.

BRITISH COLUMBIA. Katherine Capes continued investigations on Vancouver Island under the auspices of the National Museum of Canada. During the past spring and summer she excavated a contact-period site at Sandwick, one mile north of Courtenay.

The University of British Columbia began excavations at the deeply stratified Fraser Canyon site DjRi 3. The project, which is under the direction of Charles E. Borden, is being financed by grants from the National Museum of Canada, the Koerner Foundation, and the U. B. C. Committee on Research. Site surveys in the drainage system of the lower Fraser were conducted.

Assembled by CHARLES E. BORDEN

CALIFORNIA

The Southwest Museum conducted two weeks of excavations in March, 1959, on San Nicolas Island at sites SNI–38 and SNI–51 under the direction of Charles Rozaire with help from George Kritzman, Dave Rice, Edward Mitchell, and Lynn Bailey. Interest centered in obtaining quantities of woven sea grass for analysis of technique, but in addition the sites yielded shell fishhooks, bone gorge hooks and awls, and some flaked stone implements. A sea cave with incised petroglyphs was also recorded.

The San Fernando Valley State College continued its work at the shell midden site of Simomo (VE–26) near Point Mugu in southwestern Ventura County as a part of its field course in archaeology which was supervised during the Spring of 1959 by Charles Rozaire. Pits extended below the 9-foot level and produced several burials, projectile points, bone awls, bone and pestle fragments, and bone tubes with shell overlay in asphaltum.

A cooperative program by the State Indian Museum and the American River Junior College during the Easter vacation of 1959 consisted of test excavation of the Watson site (Sut-24). The field work was directed by William H. Olson for the State Indian Museum at Sacramento. Excavations at this site demonstrate that it is of special importance because it covers a period of time from Late Middle Horizon to Early Phase 1 of the Late Horizon, seemingly a period of cultural transition. Olson's work here demonstrates that this site has cultural affinities with both the central and northern Sacramento Valley regions as well as with certain aspects of the Martis complex of the central Sierra. A total of 19 burials was recovered by the State Indian Museum crew.

The Archaeological Field Methods class of the Sacramento State College under the direction of William J. Beeson has conducted a program of excavation at the Mosier site (Sac-56) on the Sacramento River south of the city of Sacramento. After two semesters of work Beeson and his crew have recovered 15 burials. This site is the type site for Phase 2 of the Late Horizon of central California. Beeson's most recent excavations, however, demonstrate that Middle Horizon materials occur in the lower levels of the site.

Assembled by FRANCIS A. RIDDELL

NORTHEAST

Historic Sites. The National Park Service, John Cotter relates, continued tests in three of its sites. During the spring of 1959, B. Bruce Powell and Jackson Moore located features connected with early utility buildings in Independence Hall National Historic Park. The investigation of the Hopewell Village, near Pottstown, Pennsylvania, continued. Former grade elevations and features connected with the original barn near the Ironmaster's House were disclosed. The development of this site is now well advanced and the new visitor center museum displays the results of the archaeological investigations. The grounds of the General Schuyler House at Schuylerville, New York, have been investigated and artifacts representing the early 19th century have been assembled. Various outbuildings and architectural features of the house itself have been identified thereby providing accuracy for interpretation and reconstruction.

Members of the Northeastern Chapter of the Archeological Society of Maryland have been working with the "Friends of Rodgers Tavern" in obtaining data for the restoration of Rodgers Tavern. They have sifted the dirt floor of the former barroom and recovered fragments of glass, clay marbles, bullets, slate pencils, clay pipe stems, and a few coins. These indicate the barroom was used during the 1860's when a horse and mule training station existed at Perry Point. Rodgers Tavern, near Perryville, Maryland, was built in 1771 and opened as a tavern in 1780. Diaries of George Washington indicate this served him frequently as a stopping place. The Society for the Preservation of Maryland Antiquity recently purchased the property.

New York City. Julius Lopez and Stanley Wisniewski have conducted historical research in connection with the Schurz Avenue and Fort Independence sites. Other members of the New York City Archaeological Group conducted a survey at Lost Village, Dutchess County, New York, finding both Indian and Colonial levels of occupation. Lopez and Wisniewski have continued studying and photographing local material in private and institutional collections.

Ontario. Clyde C. Kennedy sought the location of the island occupied by "Algommequin" Indians in 1613. This village was visited in 1613 by Samuel de Champlain. Conclusive evidence has not been recovered, but it is strongly suggested that this was located on Morrison's Island in the Ottawa River, near Pembroke. Historic material was recovered as was evidence of a Point Peninsula (Middle Woodland) occupation. Frank Ridley continued his survey of northern Ontario where he sought the locations of early trading posts.

Late prehistoric sites were investigated in several parts of Ontario. Walter A. Kenyon reports that the Pithers Point mound excavated by the Royal Ontario Museum proved to be a pile of refuse left by the Assiniboin. This identification is based upon the recovery of quantities of pottery. He also noted evidence of an Old Copper occupation in the area. Pithers Point is located at the outlet of Rainy Lake.

J. Norman Emerson, University of Toronto, examined a prehistoric Iroquoian village of the Lalonde stage in West Gwillimbury Township. This was found while attempting to salvage skeletal material from a gravel pit on Norman Bosomworth's property. Evidence of direct association between the burials and village is lacking. However, J. E. Anderson is analyzing the skeletal material which promises to provide interesting insights on the food habits of the people. Richard Pearson, University of Toronto, reports excavations on the MacDonald site, Prince Edward County. This is a prehistoric Iroquois site yielding pottery identified as early Mohawk, Onondaga, and Huron. It is thought to be a site occupied during the early 14th century and sharing traits with the Roebuck and Woodridge sites.

Wilfrid Jury, University of Western Ontario, reports continued excavations on the Forget site. This is an early prehistoric village near Wyebridge. He also located seven Huron sites in the area. Additional information on activities in Ontario is reported in "New Pages of Prehistory, 1958," *Ontario History*, Volume 51, Number 1, 1959.

Maryland. Members of the Southwestern Chapter, Archeological Society of Maryland, have been investigating the Seneca Hotel site (18 Mo 5). W. A. Tidwell gives the location of this site as near the junction of Seneca Creek and the Potomac River. The evidence recovered indicates continued, or repeated, occupation over a long period of time. Archaic material has been recovered as well as some suggesting an Early Woodland occupation. A radiocarbon reading, obtained from the U.S. Geological Survey Laboratory (Sample W–798), is 1960 ± 160 years ago, based upon charcoal recovered from a fire pit in the western part of the site. No artifacts were found in direct association with this fire pit, so the period of occupation represented is conjectural. Two additional radiocarbon dates have been obtained for the main crematory pit in the West River site (18 An 18). This site and others, near Chesapeake Bay, in Maryland, produced evidence of a close cultural relationship with the Adena Culture of Ohio. The new dates, based upon charcoal samples are consistent with two dates, obtained previously. The new readings, run by the University of Michigan, Memorial–Phoenix Project Radiocarbon Laboratory, are: M–416a; 2310 ± 200 years ago, and M–417a; 1850 ± 200 years ago.

Pennsylvania. Don W. Dragoo of the Carnegie Museum, Pittsburgh, continued investigations of upper Ohio Valley Adena sites during the summer. As well as gathering information from all known Adena sites in the area he checked collections in several institutions.

Assembled by Alfred K. Guthe

SOUTHEAST

Georgia. The Smithsonian Institution worked in the Columbia and Walter F. George basins on the Chattahoochee River with three crews under Harold Huscher, Newman, and G. Hubert Smith which dug until July

l at a series of sites, the most important of which was the Indian-Georgian town of Roanoke which burned in 1836. Other sites indicated the presence of a Macon Plateau, Early Mississippian phase on the Chattahoochee, and perhaps confirmation of Caldwell's exclusively check-stamped interval following the Weeden Island phase. Archaic sites with fiber-tempered pottery and heavy flints were found deeply buried.

The University of Georgia began excavations under A. R. Kelly and Edward V. McMichael on the Chattahoochee at the Standley Farm, with occupations extending from South Appalachian phases through Mississippian. The Bull Creek site was also re-excavated to learn more about the complex relationships of Fort Walton and Lamar with the many flamboyant features known to be present at Bull Creek. The University also conducted contract work for the Georgia Power Company at the Morgan Falls Redevelopment Project in north-central Georgia where a series of rock shelters was investigated.

The 1959 session of the Southeastern Archeological Conference will be held at Ocmulgee National Monument, Macon, on November 13–14. Robert Bray is in charge of local reservations and arrangements; Stephen Williams is general chairman of the pottery workshop sessions. It is hoped that some progress can be made towards reducing the profusion of southeastern pottery names.

The Macon Archeological Society has been investigating a large, probably earth-covered house at Brown's Mount. This site is similar to the Macon Plateau component and it is hoped that the charcoal collected will date the Macon Plateau phase. Previous samples from Macon Plateau have been rendered useless by preservation with parafin or plastic.

Florida. John Goggin and William Massey continued the excavation and underwater exploration of a number of sites in Taylor County dating from the Deptford and Weeden Island phases. The University of Florida was also engaged in the exploration of a large spring on the west coast where large numbers of human remains had been reported. Goggin continues his development of underwater techniques and equipment for underwater work which he feels can attain a stature approaching that of "dirt" archaeology. Ripley P. Bullen, Florida State Museum, excavated in a large site near Osprey, and William H. Sears surveyed in the vicinity of the Ochlockonee estuary and mapped a number of large, previously known sites. Edward M. Dolam joined the Florida State Museum as a temporary field supervisor in the summer.

At Florida State University Hale G. Smith and Charles H. Fairbanks continued the excavation of the Delp Mound with student crews. Some additional collections were also made at Sinclair Landing, the site of the Panton Leslie store. The University of Alabama and the Florida State University jointly conducted a field school in the Weiss Reservoir with the additional sponsorship of the Alabama Geological Survey and the Alabama Power Company. Three field crews totaling 34 students worked at a variety of sites under the direction of David L. DeJarnette and Fairbanks.

Hale G. Smith and Robert Steinback continued excavation in St. Augustine for the St. Augustine Historical Society, excavating structures in colonial St. Augustine which are mostly of the early 18th century.

Mississippi. Stephen Williams began the second season of work at the large Lake George site in Yazoo County, a major ceremonial center with some 25 mounds and a wall enclosing 50 acres. Three phases are represented: Coles Creek, Plaquemine, and Lake George. The 1959 excavations continued in a Coles Creek phase burial mound that has already yielded 25 burials without associated offerings. Williams hopes to work out the settlement patterns of the three phases.

North Carolina. Work continued on colonial sites. Tryon Palace, the first fixed colonial capital of North Carolina in 1770, was opened as a historic house exhibit. This work was made possible through gifts of Mrs. Maude Moore Latham. Excavation and exhibition at Old Brunswick Town continued under Stanley South.

Assembled by Charles H. Fairbanks

SOUTHWEST

On June 18, 1959, William W. Wasley, archaeologist for the Arizona State Museum, and James E. Officer, Department of Sociology, University of Arizona, visited La Cueva de las Tunas near Yécora in the sierra of eastern Sonora, Mexico, at the invitation of the University of Sonora. The trip was part of an investigation into the circumstances of discovery of the Yécora mummy, now on exhibit at the University Museum in Hermosillo, Sonora.

There was no other evidence of mummification in the cave, although some well preserved skeletal material was encountered in the disturbed cave debris. The roof and walls of this cave are definitely moist, and although there is a very dry upper layer of debris about 30 to 50 cm. thick, the lower cave deposit is quite damp. Thus, the general conditions of the cave do not appear capable of producing natural mummification. In this Wasley and Officer are in complete agreement with statements in the Mexico City press attributed to Arturo Romano, Director of Prehistory at the Mexican National Institute of Anthropology and History (I. N. A. H.). There seems to be some basis for believing that while the mummy was actually "discovered" in La Cueva de las Tunas, it was brought there from its original location.

Assembled by William W. Wasley

MIDDLE AMERICA

Mesoamerican archaeology was well represented at the Twenty-Fourth Annual Meeting of the Society for American Archaeology, Salt Lake City, April 30–May 2. Four speakers, Richard H. Brooks, J. Charles Kelley,

Charles C. Di Peso, and William W. Wasley, presented papers with important data relevant to Mesoamerican-Southwestern contacts, reporting, respectively, on work in the Sierra Madre Occidental, the Chalchihuites culture area of Durango, Casas Grandes, Chihuahua, and near Gila Bend in southern Arizona. In addition, Walter W. Taylor reported on his investigation of a cave site in Sonora, the artifacts of which display limited ties to the north and west. It is evident that northwestern Mexico, so long a relatively terra incognita on the North American archaeological map, is finally receiving the attention it has so long deserved. Northeastern Mexico, even more neglected until recently, figured in reports by Richard S. MacNeish and H. B. Nicholson. The former discussed the remarkably long sequence(approximately 9000 years) of well-preserved plant remains of southern Tamaulipas and its implications for New World agricultural origins and dispersals; the latter described a recent investigation of the largest Pueblito Tradition house-platform site in the Sierra de Tamaulipas, falling temporally in the Classic. West Mexico was represented by Clement W. Meighan's report on the UCLA excavation at Amapa, Nayarit (see below). Two participants in the New World Archaeological Foundation's project at Chiapa de Corzo, Chiapas, Gareth W. Lowe, the field director, and Bruce Warren, reported on aspects of their work in this key region of Mesoamerica's heartland: the long Preclassic architectural sequence at the principal site and the widespread ceramic connections of the third sequential phase (Chiapa III). Suzanne W. Miles and Heath-Jones presented complementary papers on Preclassic esthetic and epigraphic traditions of the highlands and Pacific slope of Guatemala and adjoining regions, sparked by the recent discovery of two extraordinary stelae at Kaminaljuyú, one with what may well be the earliest hieroglyphic text yet found in Mesoamerica, with important implications for a more accurate conception of the role of Highland Guatemala in the genesis of Classic Maya civilization. Jeremiah F. Epstein discussed the ceramic sequence of northeastern Honduras, with special attention to the so-called "Chibchan thrust" after the at least partial withdrawal of the formerly dominant Mesoamerican influences. More general papers were presented by Bertha P. Dutton, who discussed Mesoamerican ballcourts, with emphasis on their ritual-mythologic associations; William J. Mayer-Oakes, who presented a developmental concept of pre-Spanish urbanization in the Valley of Mexico, stemming from his El Risco excavation; and Thomas S. Ferguson, who discussed various symbols and cultural elements he believes were common to the ancient Near East and Mesoamerica.

Central Mexico. Sidney E. White, Department of Geology, Ohio State University, has terminated a ten-year program of geologic investigations of the late Pleistocene history of the southern end of the Sierra Nevada, the range of high volcanic peaks bordering the Basin of Mexico east of Mexico City. When the program was inaugurated in 1949 and 1950 by two summer expeditions to Popocatepetl, the ambitious intent was to date by direct means the lake sediments of the Mexico Basin, but it was discovered that glacial outwash from this volcano passed east into the Valley of Puebla and thence south through the Río Balsas Basin to the Pacific. Subsequent study of the next volcano to the north, Iztaccihuatl, in 1953, 1955, 1956, and 1959, revealed a sequence of multiple glaciation of probable Wisconsin age, but the sediment of the voluminous alluvial fans of glacial origin built against the west edge of the mountain as yet has not been traced to the lake floor in the center of the Basin. The late Pleistocene glacial sequence now established, however, may become useful in correlation for the Mexican archaeologists.

The work of the Centro de Investigaciones Antropológicas de México in the Ostoyohualco Plaza of Teotihuacan, under the direction of Carmen Cook de Leonard and Juan Leonard, last reported in the C. I. A. M. Bulletin No. 4, has been progressing. The East Pyramid was found to contain an interior structure, probably Teotihuacan I, with a stone roof and wooden posts on one side. This had been sacked in Teotihuacan III times, entrance being made through the front stairway, following which another pyramid was built over it. To test the possibility of the existence of a pyramid which had not been sacked, the central one was approached from the front. Three intact stair superpositions were found. The pyramid was pierced from the front, cutting half of the innermost staircase and a tunnel was dug towards the rear of the pyramid, from south to north. The rear part of the pyramid was found to contain a cemetery, in which 12 burials have been located, ten recovered. The offerings are mostly Tlaloc vases with ocher paint; they also included a stone frog painted red, ceremonial flint knives painted red on white, and a necklace made of human molars, and bone imitations thereof, probably arranged in circles to represent a corncob. Aside from the cemetery, two older interior pyramid structures were found, one similar to the Cuicuilco style. At the time of the first report, the access to the ceremonial center had not been found. On the south side there are remains, to one side of the exact center, which lead up to the ramp. In later times, probably Teotihuacan III, a 35-foot wide staircase coming down from the north side was used. Both entrances have two superimposed constructions.

Oaxaca. During December and January of 1958–59, Ignacio Bernal worked at Yagul. A large amount of superficial clearing and some stratigraphic work was accomplished in a complex of six or seven patios and their surrounding rooms, both patios and rooms practically identical to those in the group of the church at Mitla. Even though most of the work consisted only of clearing the debris from these structures, the results of the season are judged to have been quite important. Relatively abundant finds of polychrome pottery constitute the most striking discovery. This material includes some which seems to conform rather closely to Cholulteca style, but most of it appears to be a previously unknown variant of Mixtec-style polychrome. Excavation in a large pit revealed that these structures of pure Mitla style were

rebuilt and superimposed several times in the same place. In addition, the diagnostic Mixtec style polychrome was found in considerable quantity under the uppermost floor. It occurred, along with the diagnostic Mixtec-style gray wares, in decreasing quantity under the earlier floors. Bernal is presently pursuing the analysis of these finds and hopes to continue work in the same group during the winter of 1959–60 to finish the clearing and to carry forward other aspects of the investigation.

At the time of this writing, the Mexico City College group, under the direction of John Paddock, was planning to conduct a week and a half of their summer archaeological field school at the Caballito Blanco site, near Yagul, first explored last year. Their next regular field session, planned for the winter of 1959–60, may carry forward the work at this important site.

West Mexico. The excavations of the University of California (Los Angeles) at Amapa, Nayarit terminated in March. They were directed by Clement W. Meighan who was assisted by Betty Bell, Mildred Wissler, Jack Smith, Gordon Grosscup, Frank Clune, and David Pendergast, all graduate students at U. C. L. A. Highlights of the season include the discovery of well over 600 whole or restorable pottery vessels, decorated in a remarkable variety of diverse styles (many new to West Mexican archaeology), the majority found in two rich cemetery areas in which over 100 graves were recorded; the northwesternmost ballcourt yet excavated in Mesoamerica, capital I-shaped, partly of stone construction, with circular stone center markers of unique shape; two large mounds with cut stone stairways, unexpected this far northwest in Mesoamerica; and various incised stone slabs, displaying both anthropomorphic and zoomorphic motifs. Temporally, the occupation of the site almost certainly began some time during the Middle or Late Classic, although the major manifestation appears to fall in the early Postclassic (flattish Mazapan-like figurines and copper objects were fairly common in certain areas of the site). Analysis of the large collection is now underway, in which a number of U. C. L. A. graduate students who participated in the excavation are playing a major role.

Chiapas. In February, Richard S. MacNeish, in conjunction with the New World Archaeological Foundation and assisted by one of their collaborators, Frederick Peterson, excavated a rock shelter with important results. The stratigraphy within the 2.5-meter refuse deposit was very clear, the top stratum containing in its upper portion some Postclassic sherds but mainly consisting of Classic materials. The next level contained some Classic and very late Formative (Chiapa V) remains. Zone C was pure Chiapa I and very early Formative. Zones D, E, F, and G were all preceramic and belong to what MacNeish is calling the Santa Marta complex. In these zones were found four skeletons, a cob of Pod-Pop corn, and over 100 lithic artifacts, including flake side scrapers, domed and flat top scraping planes, ovoid bifaces, pebble and slab choppers, crude blade tools struck from conical polyhedral cores, pebble manos and boulder mullers, as well as four types of projectile points closely resembling certain types previously found by MacNeish in Tamaulipas. Further work is contemplated in other dry caves of this region. This is the first well-documented preceramic phase yet delimited in Highland Chiapas and extends the long sequence there considerably back in time.

Lowland Maya Region. The first season's excavation of Altar de Sacrificios, near the junction of the Chixoy (Salinas) and Pasión rivers, in the southwest Petén, Guatemala, ran from February to May. This project, financed by the National Science Foundation, is directed by Gordon R. Willey of Harvard University. A. Ledyard Smith is field director and was assisted this season by John Graham and William Bullard. A sizable camp installation was completed, the major ceremonial units were mapped, and numerous outlying smaller mounds were discovered. Important new discoveries include a ballcourt of the Lowland Maya Classic style and a new stela which bears a 9.9.0.0.0 date (tentative reading). The site was unquestionably occupied throughout the Classic and was probably a major center for esthetically superior, carved Fine Orange pottery, probably of the Y variety.

Willey also reports that the analysis of the ceramics recovered at Barton Ramie during the Harvard Lowland Maya settlement patterns project of 1953–56 is well underway, with James C. Gifford assisting. The final report of the project is being prepared; it will be based upon the work at Barton Ramie but will include observations on prehistoric Maya settlement patterns of the Belize Valley generally and in other parts of the Maya Lowlands.

The University Museum of the University of Pennsylvania pursued its fourth season of major archaeological and ecological investigations at Tikal during the spring and summer months. The field staff, under the direction of Edwin M. Shook, consisted of W. R. Coe, Vivian Broman, Stuart Scott, W. A. Haviland, Linton Satterthwaite, and George Guillemin, archaeologists; A. S. Trik, architect; R. F. Carr, surveyor; and M. B. Ricketson and B. Levine, laboratory assistants. Ecological studies were carried on by F. B. Smithe (ornithology), C. L. Lundell (botany), Edwin Littman (chemistry), and George and Ursula Cowgill (pollen). Additional archaeological staff for summer excavations included Ann Chowning, Keith Dixon, Peter Harrison, Philip Auerbach, and Norman Johnston.

The long Preclassic sequence of occupation in the Great Plaza, encountered in 1958, was intensively investigated, as well as overlying Classic and Postclassic remains. Excavations penetrated from surface to bedrock wherever practical in an extensive zone of the center of the site. The bedrock surface in each case had been modified by the early inhabitants so that no undisturbed remains comparable to the black dirt or Mamón level at Uaxactún have yet been found in Tikal. Mamón ceramic types occur mixed, presumably through redeposition, in late Preclassic (Chicanel) levels.

Deep trenching and tunneling of Early and Late Classic structures brought to light further evidence of the changing complexity of Maya ceremonialism and the cultural disjunction between Preclassic and Classic Maya culture, as well as evidence of internal strife during the Classic Period.

One large, formally constructed vaulted tomb, intrusively cut into the stairway of Structure 34 (Temple of the Red Stela), was found to be empty, evidently sacked during the occupation of the site. Farther inside the same structure and deeply penetrating underlying limestone bedrock, another large, richly stocked tomb was discovered. This important interment just preceded the construction of the Early Classic Temple of the Red Stela. Also encountered on the axial line of the temple was a votive cache with a covered pottery vessel containing among shells and other marine offerings an exquisitely modeled Maya head encrusted with jade and shell elements.

The breakage, disturbance, resetting of stela fragments, the epigraphy, and the offerings associated with stelae were studied by Coe, Haviland, and Satterthwaite. They and Guillemin continued the assemblage, repair, and re-erection of Tikal monuments, while Trik initiated the architectural repair of Great Temple I and a twin pyramid complex in Group E. Casts of the original carved wood lintels from Temple I were replaced, and the interior of the temple completely repaired.

The important H Group area north of the center of the site and joined to it by two large causeways was mapped by Car. He discovered numerous architectural units not previously known, several plain stelae, carved Stela 30, and Altar 14 (which bore the Initial Series date: 9.13.0.0.0). Other newly discovered carved stelae and altars include Stela 27 (9.3.0.0.0), 28 (undated, Early Period), and 29, which bears the earliest contemporaneous Initial Series date (8.12.14.8.15) so far found in the Maya area, predating Stela 9 at Uaxactún by 36 years and the Leyden Plate by 28 years.

The summer excavations, still in progress at time of writing, have initiated investigations of domestic architecture and associated household rubbish. Selected for thorough excavation were several low housemounds, which had not been visible in the dense tropical forest until extensive clearing had been done. These mounds did not appear on the accurately surveyed topographic map of the area, but showed up as low undulations on the ground surface when vegetation was removed. The excavations, covering only a small restricted area, have brought to light a complex arrangement of platforms and terraces just under the surface, over 10,000 potsherds, quantities of stone, bone, and shell artifacts, burials, caches, and so on. The uppermost levels contain early Postclassic plumbate pottery, spindle whorls, incensarios, and a ceramic complex heretofore ill-defined in the Petén. This, in addition to evidence from the previous season's excavations, indicates that habitation did not cease entirely at Tikal after the Classic, as was widely believed previously. Tohil Plumbate and X Fine Orange found in Tikal demonstrate a certain amount of occupation during early Postclassic times, while other ceramic types, especially censers, further indicate some activity here as late as late Postclassic times.

J. Eric S. Thompson, the dean of living Mayanists, now resident in England, recently completed a trip to Mexico and British Honduras, where he visited various archaeological sites. In Mérida, he was awarded an L.L.D. by the Universidad de Yucatán, in recognition of his many signal contributions to Maya culture history, particularly his fundamental epigraphic and calendric studies. He is continuing work on his great catalogue of all glyphs (excluding the strictly calendrical) on the monuments and hopes to have a summary of his progress ready soon. Thompson's *Maya Hieroglyphic Writing: Introduction* (1950), indispensable to all workers in this field and long out of print, is scheduled for a limited second edition, in offset, at a moderate price, to be published soon by the University of Oklahoma Press.

Mayanists were saddened during the early part of the year by the death, at 93, of the distinguished Yucatec Maya scholar, Juan Martínez Hernández, whose work with the Maya chronicles and the calendric correlation problem is well known to all students of Mesoamerica's past.

Central America. Wolfgang Haberland of the Museum für Volkerkunde, Hamburg, is continuing his vigorous program of Central American investigations. During the past year he undertook the following surveys and excavations.

In El Salvador he pursued studies intended to supplement the results of his earlier 1953–54 season, with the particular aim of clarifying the status of certain putatively Formative phases, Atiquizaya in the west, and Gualacho and the sequent Los Frailes phases in the east. The first two appear to fall more or less at the beginning of their respective sequences in these fundamentally different regions. Atiquizaya seems to be the earlier, with clear connections with the Guatemala highlands, possibly on a time level as early as Las Charcas. Haberland has worked out a tentative sequence, largely based on typology, for both western and eastern zones. Through cross-ties between east and west and from the west to the Maya area, he has been able to construct a tentative chronologic framework. In the central region of the country he sank a stratigraphic trench into a large pyramid crudely constructed of boulders, called San Francsico, near Aguilares, which may display two construction phases. Although sherds from the surrounding area indicated that it might date from Pipil times, sherds found in the fill supported a Late Classic or early Postclassic date for the structure. He also did considerable photographing of pieces in private collections. He is presently working on a report intended to clarify the still very confused Salvadoran sequences, which will include evidence that the important Usulután Complex should be split up into different time levels.

In Nicaragua he devoted most of his stay to testing sites in the vicinity of Moyogalpa, on the island of Ome-

tepe. In addition to plentiful quantities of sherds, a shaman's grave and what appeared to be a ceremonial dog burial were found. Some further very limited testing was undertaken in the Granada area, where Willey was later active.

In Costa Rica, with Buenos Aires in the Valle del General as base, Haberland further investigated the Boruca phase of Classic Chiriquí, excavating 37 burials in three different cemeteries. He also located a habitation site, heretofore virtually unknown in this region, and surveyed the Osa Peninsula where he found indications of a new Chiriquí phase. He now believes that Classic Chiriquí must be divided into at least seven distinct phases: Boruca, Highland Chiriquí, Lowland Chiriquí, Armuelles, Osa, Río Diquis, and Coto Brus (the last two somewhat more problematical). Investigations near Dominical on the Pacific coast off San Isidro del General also yielded some generalized Chiriquí material.

In Panama, Haberland concentrated his efforts at Chiriqui, focusing on the problem of the temporal placement and spatial distribution of the Formative Aguas Buenas phase, previously located by him in the area of the Costa Rican boundary. Six more sites were located, in a large area, whose artifact complexes were essentially similar. In an attempt to place chronologically the well-known stone statues of the Barriles area within the Chiriquí sequence, a test was made where Stirling had dug ten years previously. The finding of unmistakable Aguas Buenas sherds suggests that the statues belong to this early phase and are probably at least as old as A.D. 1000. In addition, various Classic Chiriquí burials were excavated near La Concepción. In connection with this work, evidence was uncovered of two new phases at two different sites, one of which appears to be approximately coeval with Aguas Buenas. The other (Villalba), exposed near David, contains some crude stone monuments and appears to be coeval with Classic Chiriquí; there are some indications it might prove to be transitional between this phase and Veraguas. Tests were also made around Guararé on the Azuero Peninsula, where quantities of sherds, bones, and shells were recovered from habitation sites and where the artifact assemblages, although displaying certain regional differences, in general appearance were quite similar to those of the Parita region, where Willey excavated.

Haberland also visited Colombia, where he photographed extensively in the museum collections and undertook two small test digs in the region of Medellín. He is presently engaged in analyzing the materials recovered on this extensive field trip and preparing reports and articles for publication.

Gordon R. Willey, assisted by Albert H. Norweb, conducted an archaeological exploration of Nicaragua during February, March, and April, with particular emphasis on a search for materials which might belong to a Formative period level. Surface collections were taken from 12 sites on the Isthmus of Rivas, between Lake Nicaragua and the Pacific, and at five of these test-pitting operations were conducted. Although the sherd collections recovered have not yet been analyzed, Willey does not believe anything was found which looks as though it might be on a Formative chronological level. However, ceramics in the National Museum of Nicaragua were seen which appeared to have definite Formative resemblances, including the incised Palmer style and Usulután spouted jars. Continuation of the project is planned for next year.

Compiled by H. B. NICHOLSON

LOWLAND SOUTH AMERICA

BRAZIL. The program of fieldwork sponsored by the Centro de Ensino e Pesquisas Arqueológicas, University of Paraná, is continuing actively under the leadership of Wesley R. Hurt and Oldemar Blasi. In January salvage operations were conducted at a cemetery and village site at Porto Brasília on the bank of the Rio Paraná, northwest Paraná state. While the area was being cleared for settlement, five large polychrome vessels containing secondary burials were encountered. Excavation revealed the existence of habitation refuse 50 cm. in depth in the same area. Stone artifacts were rare and consisted principally of choppers and scrapers. Pottery decoration includes polychrome painting, fingernail impression, corrugation, and incision. The complex resembles that reported by Virginia Watson at a Spanish-Guaraní site farther downriver, which is dated between A.D. 1554 and 1750.

During February two sites were investigated by Hurt and Blasi at Barracão in southwest Paraná. The refuse deposit was again about 50 cm. in thickness. Sherds were sparse and undecorated, but several hundred stone artifacts were recovered, all of red basalt. Types include plano-convex nuclei, "scraper-planes," unifaced blades and scrapers, and retouched flakes, the majority of which may be artifacts in a primary stage of manufacture rather than completed products. This situation along with the scarcity of pottery suggests the sites may be "workshops" rather than habitation areas, although no quarries were found in the immediate vicinity.

One of the most important events for anthropology in Brazil in recent years is the acquisition of the 300-year old Jesuit Monastery at Paranagua in the state of Paraná for a museum of archaeology and folk arts. This building will house the exhibits and laboratories of the Centro de Ensino e Pesquisas Arqueológicas of the University of Paraná and will serve as a research center for investigation of the numerous sambaquí sites that occur in the vicinity. The museum was dedicated in the latter part of July, when it served as host to the 4th Reunion of the Association of Brazilian Anthropologists.

During March, 1959, Peter Paul Hilbert continued his investigations in the Amazon region under the auspices of the Instituto Nacional de Pesquisas da Amazonia and with the assistance of PETROBRAS. Excavations were undertaken in the vicinity of Tefé on the right bank of the Solimões. Sherds were abundant and refuse extended to a depth of 60 to 90 cm. Several sites were subjected to

stratigraphic tests and analysis of the material will add greatly to our knowledge of the area.

URUGUAY. During January, 1959, an expedition sponsored by the Museo Histórico Nacional investigated a lithic site in the Department of Artigas. Participants included Raúl Campa, Antonio Taddei, Lisandro Leonardi, Carlos Alberto Passos, and Dick Edgar Ibarra Grasso. Artifacts, encountered over a rather large area with several concentrations, consist of hand axes, scrapers, lance points, gouges, punches, and similar tools. None exhibit secondary retouching. Some 5000 specimens were taken to the Museo Histórico Nacional, and the study of the site and its contents is expected to continue. Preliminary analysis suggests affiliations with early lithic industries of Bolivia and Patagonia.

Assembled by BETTY J. MEGGERS

ABSTRACTS OF NEW WORLD ARCHAEOLOGY

The first volume of *ANWA* is scheduled to appear during the summer of 1960 and will be distributed with AMERICAN ANTIQUITY to all members and institutional subscribers without extra charge. Additional copies will be printed for separate sale.

The editorial staff will attempt to prepare abstracts of all publications dated 1959 that deal with New World archaeology, regardless of place of publication or language. Books, monographs, serial volumes, and journal articles will be included. In addition, it is hoped that abstracts can be obtained (or at the very least titles) of all M.A. and Ph.D. theses on New World archaeology accepted during 1959; it will be greatly appreciated if anyone knowing of such a thesis will notify the Editor of *ANWA*, Richard B. Woodbury, Department of Anthropology, University of Arizona, Tucson, Arizona. All abstracts will be in English, will be non-critical, and will include full bibliographic information. We will attempt to convey briefly all the essential information of the original.

One of the Society's major long-range aims in instituting this abstract series — and an aim of the Charles F. Brush Foundation in supporting it — is to encourage other journals to publish regularly an abstract of each article. Whenever this is done *ANWA* will expect to use this abstract, and it is hoped that eventually its staff will need to prepare only a minority of new abstracts. For the present, it will greatly assist in the preparation of the first volume of abstracts if authors of any 1959 publication that they believe should be included would send a copy of it to the Editor of *ANWA*, who will forward it to the appropriate abstracter. Where authors cannot furnish copies, notification of the title (with *full* bibliographical information) will be helpful. Other material, not received from authors, will be abstracted, too, of course, insofar as the editorial staff is able to do so. In addition, any titles for 1957 or 1958 that were omitted from the last two listings of "Some Recent Publications" in this journal should be sent (with bibliographical details) to the Editor of *ANWA* for listing in the first volume.

INFORMATION FOR AUTHORS

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KIDDER, A. V., J. D. JENNINGS, AND E. M. SHOOK
1946 Excavations at Kaminaljuyu, Guatemala. *Carnegie Institution of Washington, Publication* 561. Washington.

JENNINGS, J. D. (EDITOR)
1956 The American Southwest: A Problem in Cultural Isolation. In "Seminars in Archaeology: 1955," edited by Robert Wauchope, pp. 59–127. *Memoirs of the Society for American Archaeology*, No. 11. Salt Lake City.

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